

# AUTOMOTIVE INDUSTRIES

## AUTOMOBILE

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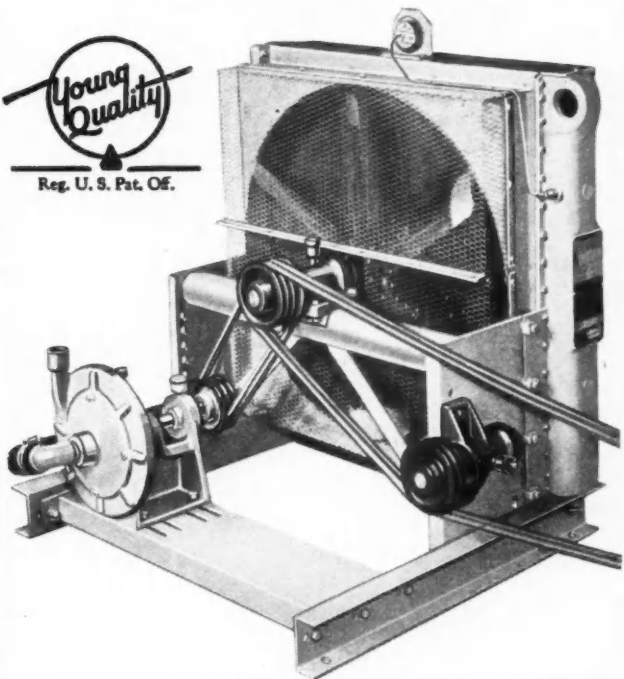
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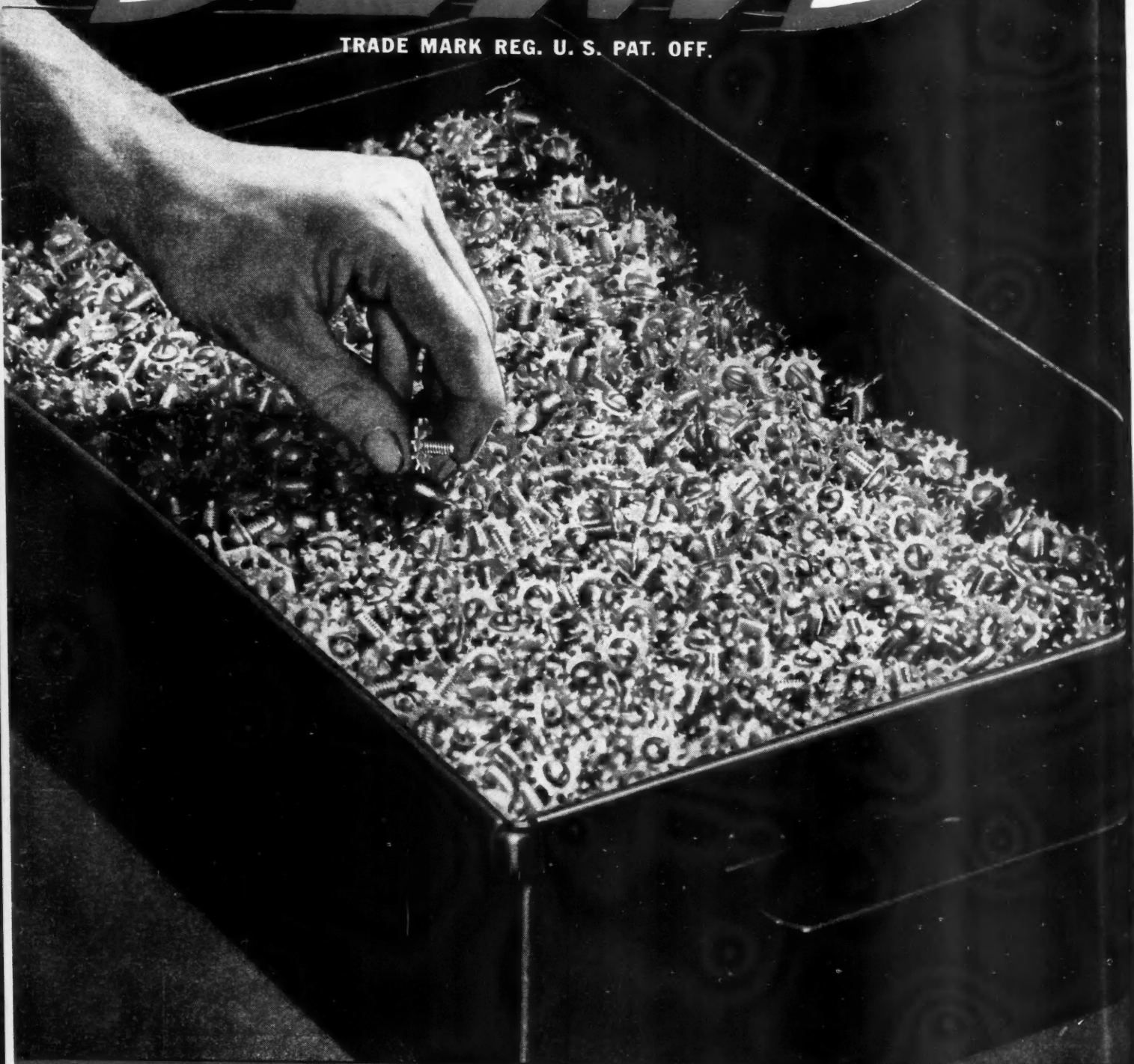
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A COMPLETE FASTENING UNIT . . . .  
Ready for Application!



# IN THIS ISSUE . . .

## AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.  
Volume 80 June 1, 1939 Number 19

**T**HE World Automotive Engineering Congress is holding meetings in New York, Detroit, Indianapolis and San Francisco so that it can be literally said that the scope of the big get-together is nation-wide in its stretch from coast-to-coast. Add to this a breadth of subjects discussed by authoritative speakers from just as broad a field, extending even across the Atlantic, much of moment can be expected.

The gamut of subjects runs from research to shop practice, from metallurgy to machining, so there is "real meat" for any special problem child in the worry family.

In this issue will be found digests of a number of the papers presented by both American and European authors. Space limitations would not permit presentation of them all now, so look for some more in the coming issue.

**I**N May 30 each year there is run off at the Indianapolis Speedway the great 500-mile classic. There is the big test ground of the industry where many of the new things of yesterdays have first come to light and been assayed in this gruelling event. Each year brings forth developments that many times find their way to passenger and commercial cars later. In many features the Indianapolis Race is a barometer of what the car of tomorrow may be.

In this issue there is a digest of what the entries have brought forth to enhance dependability and increase speed. A pressing publication date does not permit the complete story, so the reader is urged to look to the next issue as well.

**"I**UR hero" is with us again this month with an "original" idea on production lines. (See page 640.)

Miss Hobson has not yet appeared. Looking forward to meeting her. 'Tis said that she is a most interesting gal.

**F**ROM the viewpoint of public safety it was not long ago that the automobile was the subject of much concern. Cartoonists in the daily press took it apart in fine style as previously others had done with the steam railroads.

Some of these cartoons came to hand recently and they will be reproduced in an early issue. Watch for them. They are amusing.

*Automotive Industries*

### GENERAL

#### Up the Hill and Over the Top

Page

639

In this article B. C. Heacock, of the Caterpillar Tractor Co., gets a lot of data together in one place on the track-type tractor, and presents it in a most interesting manner.

### PRODUCTION

#### Method Study Promotes Economies

642

Our Detroit engineering editor made a visit and out of it came the kind of story that was more than interesting. It is highly informative. The luxuries of a few years ago have come within the general scope of all today. How it was done by AC is the story.

### ENGINE DESIGN

#### Engineering Drawings

655

For the men who like to check and compare we are printing in this issue mechanical drawings of the 90 hp. Oldsmobile six-cylinder engine.

### DESIGN

#### World Automotive Congress

656

From injection systems for Diesels to metallurgical research; from a review of European trends to body construction in America in the papers digested in this issue.

### NEW DEVELOPMENTS

#### Men and Machines

668

There have been a number of new developments in shop equipment recently that the up-and-coming production engineer should know about. In this article you find them described as well as illustrations of some of them.

### NEWS

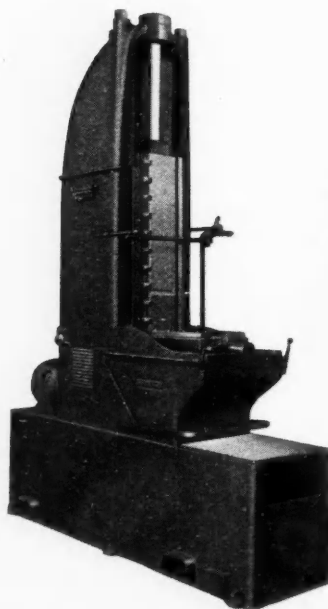
#### That Truth May Prevail . . .

670

In a campaign to establish in the public mind a better understanding of advertising, General Motors has blazed the way. Just what is aimed at and the initial step is told and shown.

June 1, 1939

**THESE ODD SHAPES  
ARE NO HINDRANCE  
TO HIGH PRODUCTION**



Odd shaped parts are sometimes difficult to broach rapidly, because they're awkward to handle and hard to hold securely in the fixture. But here's a case where the production of odd shaped steering knuckle support arms exceeds by about 100% the original requirements.

The equipment consists of a CINCINNATI No. 2-36 Single Ram Vertical Hydro-Broach, having a receding table, and equipped with a simple air operated fixture. Fatigue is reduced to a minimum by the fixture arrangement, while the table retraction is sufficient to allow plenty of clearance to load and unload the part.

**Job data:**

<b>Machine:</b>	<b>No. 2-36 Single Ram Vertical Broach</b>
<b>Part name:</b>	<b>Steering Knuckle Support Arm</b>
<b>Operation:</b>	<b>Finish Broach Inside Yoke Faces</b>
<b>Material:</b>	<b>Steel Forging</b>
<b>Stock Removal:</b>	<b>3/32"</b>
<b>Production:</b>	<b>254 per hour</b>

Send us blue prints of your surface-finished production parts. Chances are that we can reduce costs for you and improve quality.

**P.S.** Would you like to have a catalog (No. M-834) covering our Single Ram Vertical Hydro-Broach Machines? A copy is yours for the asking.

**THE CINCINNATI MILLING MACHINE CO.**  
**Cincinnati, Ohio, U. S. A.**

# Up the Hill and Over the Top

## *with Track-type Tractors Since 1904*

By B. C. HEACOCK\*

**I**T WAS in 1904 that the Society of Automotive Engineers was formed; that the first Vanderbilt Cup Race was held; that the first Maxwell, Reo, Stoddard-Dayton and Studebaker automobiles appeared on the market; that Prest-O-Lite headlights were first offered. And in that year the track-type tractor was first produced.

The new machine traveled across the softest footing without miring—making it possible and practicable to cultivate economically some of the most fertile farmland on the earth. How much land, around the globe, is now in cultivation only because of the track-type tractors there is no way of knowing, but it is an enormous acreage.

Construction was commenced on the Los Angeles Aqueduct shortly after the first of these machines proved its worth. The contractors had started to use mules to haul equipment and supplies over the Mohave Desert to Owens Lake, but the mules could haul little payload after enough food and water had been placed aboard the freight wagons to maintain the animals on the torrid trip across the desert. So the builders turned to the new tractor that was being offered with a gasoline engine instead of the original steam power-

plant. Good water in abundance was made available to a large and rapidly growing population at an earlier date.

Word of the new machine slowly spread to other fields. It was a great boon in the rice fields where the water buffalo and the coolie had been the only sources of power. Here was a machine that could pull giant tools through the mud—that could plow and plant and harvest under the most adverse conditions—because it put less weight on the ground per square inch than a man does with his foot.

One of the first agricultural tractors went to the rice fields of Louisiana—others went to rice ranches in California. These track-type machines have worked such a miracle in the rice fields that this great staple crop is being produced in American fields, under American standards of wages and living conditions and is being shipped across the Pacific Ocean and sold in China and Japan in direct competition with rice that has been produced in those countries by coolie labor receiving only a few cents a day.

In no field has the influence of these machines been more profound than in that of road building. They carved new roads through swamps, across deserts, over mountains and boundless stretches of prairie. They worked in wet ditches or on newly made fills. They climbed steep grades and clung to treacherous hillsides. They pulled big loads wherever roads were to be built. The track-type tractor not only successfully accomplished construction feats that had never been tried before, but it powered the hitherto costly job of road building at great savings.

Snow, of course, presents its own problem for roads good and bad, but here again the track-type tractor contributes its services to the speedy and economical removal of snow from both primary and secondary roads—extending its use through the 12 months of the year.

When speaking of a contribution to economic and social life, it might be well to defend the track-type



*A track-type tractor puts less weight on the ground, per square inch, than a man does with his foot*

\* From the paper presented by Mr. Heacock, president of the Caterpillar Tractor Co., at the World Automotive Engineering Congress of the Society of Automotive Engineers, at New York, May 24.



tractor in considering the part it played in the World War. European land owners had been using the machines for several years before the outbreak of this catastrophe, and military men were not long in discovering that this was just the type of prime mover they wanted to haul artillery and supplies over rough terrain. The tanks, contrary to a popular misconception, were not the product nor an adaptation of the product of American tractor manufacturers, though admittedly inspired by the track-type tractor. The thousands of track-type tractors that were used in the World War served to displace horses and mules for hauling power—perhaps even in that service they made a contribution to progress. In any case, the war did one thing—it popularized this type of machine—showed its possibilities as a builder rather than as a destroyer.

Another contribution of the track-type tractor is synonymous with the term "selective logging." Today, more and more, the forests are being regarded as a farmer would look upon his crops. The timberman now rotates the harvesting of his tree acreage. The seedlings and the young timber are left unharmed as he selects only the more mature and the desired varieties from a given section.

It serves in another way, too. Forest fires annually take a vast toll. Today track-type tractors are at work in national forest areas and on privately owned tracts, cutting broad fire trails to limit the area of damage should the demon of fire begin its destruction.

We of the United States are enjoying the benefits of industrial, heating and cooking gas much earlier because of the track-type tractor which has been chiefly responsible in the efficient and speedy laying of pipe lines in a great network throughout the country. These lines are more direct, simply because this type of tractor disdains rough terrain and soft ground.

In the oil fields, track-type tractors have helped to solve some of the most difficult power problems. Oil, like gold, is where you find it, and oil field derricks, drill rigs and mud pumps are heavy. Transporting such loads through mud, up steep hills and across roadless country was one of the first tasks the track-type tractor found to

do in the oil fields. Then the tractor winch found widespread use in lowering and pulling casing and servicing wells.

Telephone companies have their problems, too. Cables and pole lines must frequently go overland on the shortest possible route. Special equipment has been designed for the track-type tractor to save time and money on such operations. One of these tools is the posthole digger that puts down a hole for a telephone pole in less than a minute and then puts the pole in place before it moves on to the next station. The familiar tractor winch is used for stringing wires and cable along the poles, but perhaps the most interesting development of all is a special cable laying outfit, pulled by one or more track-type tractors, that marches across country laying telephone cable as it goes.

Railroads know how efficient and economical are these land locomotives that travel on their own steel rails to build new grades, power portable compressors for tie tamping, rock blasting and spray painting; that operate welders for building up worn frogs and switches; that dig holes for telegraph poles and signal systems, and that pull power mowers to cut weeds along the right-of-way.

The harnessing of rivers to make productive millions of acres of land, to supply electric power, to eliminate floods and to supply metropolitan areas with an adequate, wholesome water supply, has been one of man's oldest major contributions to society. These gigantic projects such as Shasta, Boulder, Bonneville

and Grand Coulee dams, the All-American Canal, the Muskingum Valley flood control project consisting of 14 dams, the Staines Reservoir to serve London, the high levees of the Mississippi River, owe something to track-type tractor power.

The track-type tractor has occupied a prominent spot in the reclamation of the tremendous acreage of eroded land and in protecting a far greater amount against the ravages of erosion. Fleets of track-type tractors have been purchased by counties, states and contractors to speed the work of terracing.

The track-type tractor has found a place for itself in hauling long trains (Turn to page 691)



"Understand what I want? . . . Our cars should be coming off the assembly line like that."

# BUSINESS IN BRIEF

*Our own view of automotive production and sales;  
authoritative interpretation of general conditions*

**P**RODUCTION of cars and trucks during May averaged between 75,000 and 80,000 units weekly with preliminary estimates<sup>1</sup> indicating that total output for the month would be in the neighborhood of 325,000 units at least.

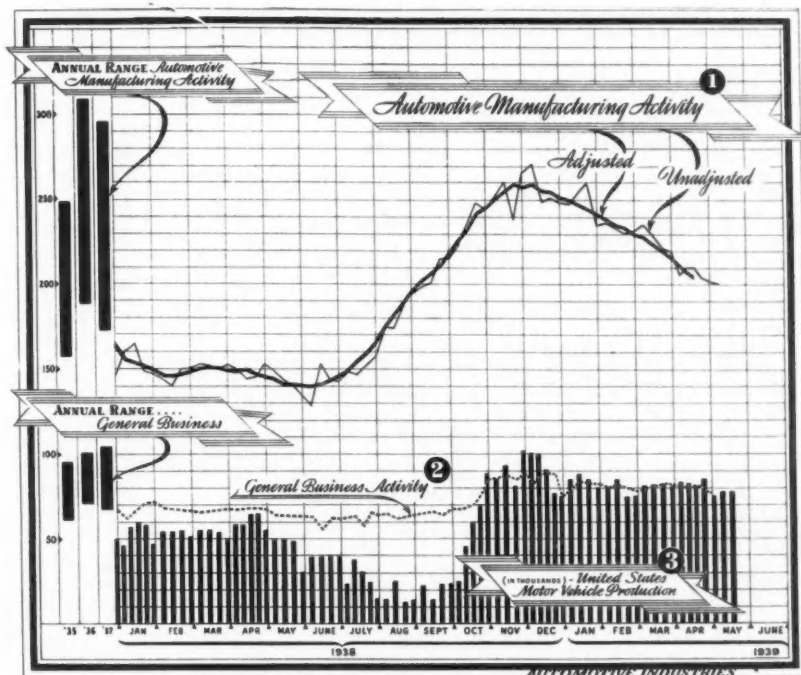
Schedules for the remainder of the 1939 model runs were strictly dependent on retail deliveries with practically all producers working toward keeping dealer stocks well rounded and complete without being overstocked for the several summer sales months still expected on 1939 models.

Production was expected to continue at a steady pace during June, although weekly totals for the industry probably will be lower than those maintained in May. Some producers expect a gradual tapering off in production during June while others seemed confident that they would continue at approximately the same rate currently in effect. June probably will be the last full month of passenger car production and it is expected that a number of schedules will be extended well into July if not entirely through that month.

Early May sales figures indicated that retail deliveries were running ahead of April, while several producers reported that dealers were making material reductions in used car stocks.

**AUTOMOTIVE MANUFACTURING ACTIVITY** for the week ended May 6, as indicated by the unadjusted index curve<sup>1</sup> on the accompanying chart, went down to 202, two points below the previous recording.

<sup>1</sup> 1923 average = 100; <sup>2</sup> Prepared by Administrative and Research Corp., New York. 1926 = 100; <sup>3</sup> Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES. <sup>4</sup> Summarized for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co. of New York.



**Weekly indexes of automotive and general business  
charted**

## Industry Faces June with Optimism

For the week ended May 13 the unadjusted index curve fell two more points to 200.

The adjusted curve<sup>1</sup> dropped three points to 209 for the week ended April 15, and fell four more points to 205 for the week ended April 22.

**GENERAL BUSINESS ACTIVITY<sup>2</sup>** appeared to reflect a renewed steadiness for the week ended May 13. The index of the Journal of Commerce for the weeks ended April 29, May 6, and May 13, respectively, was

reported at 81.4, 78.1, and 78.3.

Railway freight loadings in the week ended May 13 totaled 555,396 cars; 572,857 cars for the week ended May 6; and 586,015 for the week ended April 29.

Slower retail trade for the week ended May 13 was reported by Dun & Bradstreet, contrasting with a substantial expansion in the preceding week, when department store sales, as reported by the Federal Reserve System, were 22 per cent above a year ago.

The output of electricity by the light and power industry in the week ended May 13 rose less than seasonally but was 10.3 per cent above the corresponding 1938 production, as compared with a similar excess of 11.6 per cent for the preceding week, and 12.6 per cent for the week ended April 29.

Professor Fisher's index of wholesale commodity prices declined last week to 79.7 from 79.9 for the week before, which latter stood unchanged from the week ended April 29.

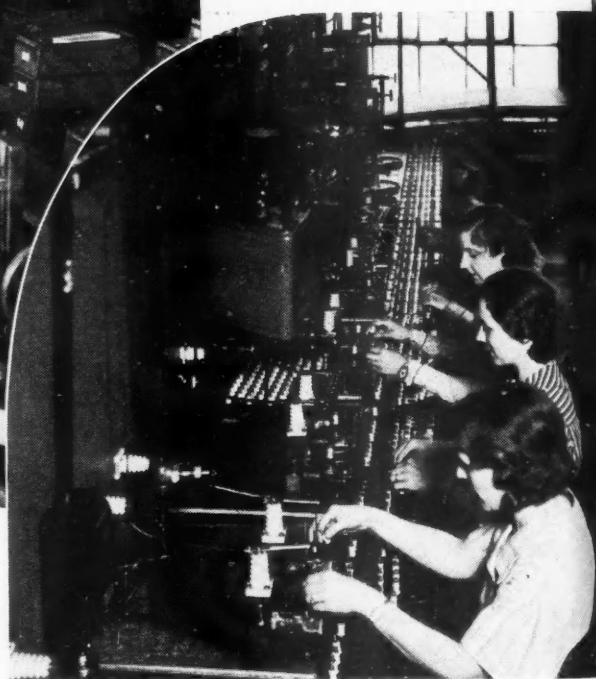
The General Motors-Cornell world price index of 40 basic commodities for the week ended May 6 was 61.0, compared with the previous week's figure of 60.9 and the figure of 60.5 for the week ended April 22.

# Method Study

## AC Operating



*(Left) Looking down a fuel pump final assembly line. Note particularly the bench conveyor with offset at forward end to facilitate the sub-assembly operation.*



*High voltage static charge is applied to check dielectric quality of AC spark plugs. This view shows a final inspection bench.*

**O**NE of the oldest names in the industry, certainly one of the largest of the parts producers, is the AC Spark Plug Division of General Motors Corp., which celebrated its 30th anniversary of service to the automotive industry last year. Founded late in 1908 by Albert Champion, premier racer of his day, primarily for the manufacture of spark plugs, the company has flourished and grown to its present stature encompassing the development and manufacture of 28 major items of equipment, some one or more of these products being found on every make of automotive vehicle in current production in this country.

To understand the scope of this organization, it is well to note a few of its contributions to the industry.

Among these may be mentioned—the development of a positive fuel feed system, obsoleting the vacuum tank; carburetor intake silencers, air cleaners, oil filters, speedometers, and a variety of essential instruments. Major contribution was the standardization of the 18-mm. spark plug at a time when the industry was wrestling with  $\frac{7}{8}$ -in.,  $\frac{1}{2}$ -in.,  $\frac{3}{4}$ -in., and even 1-in. threads with all manner of thread shell forms and lengths.

Standardization not only simplified the manufacture and application of spark plugs, reducing the variety from some 80 down to only about nine basic plugs, but has proved a boon to engine designers in providing a "heat range" which can be accommodated to the requirements of engine service. When engines reached



# Promotes Economies . . .

***Close harmony of engineering and production staffs develops highly mechanized handling for 28 major items of automotive equipment***

*Perspective of section of one of the two principal spark plug assembly lines.*

*This is the  
Thirty-eighth in the  
series of monthly  
production  
features*



*One of the most interesting examples of methods study applied to a high production machine line is this line for the machining of die cast speedometer main frames (see routing for details). Note particularly the skill with which communicating operations are interconnected by conveniently placed chutes. The endless belt conveyor parallels the machine line for its entire length.*

the point of current need for still wider heat range, AC developed the 14 mm. size, and finally the 10 mm. plug.

Appreciating the close harmony of engineering and production functions in modern practice, AC boasts a separate engineering group for each of the major divisions of its product development. Quite naturally this has resulted in the maintenance of one of the largest engineering staffs in its field.

From the standpoint of modernization

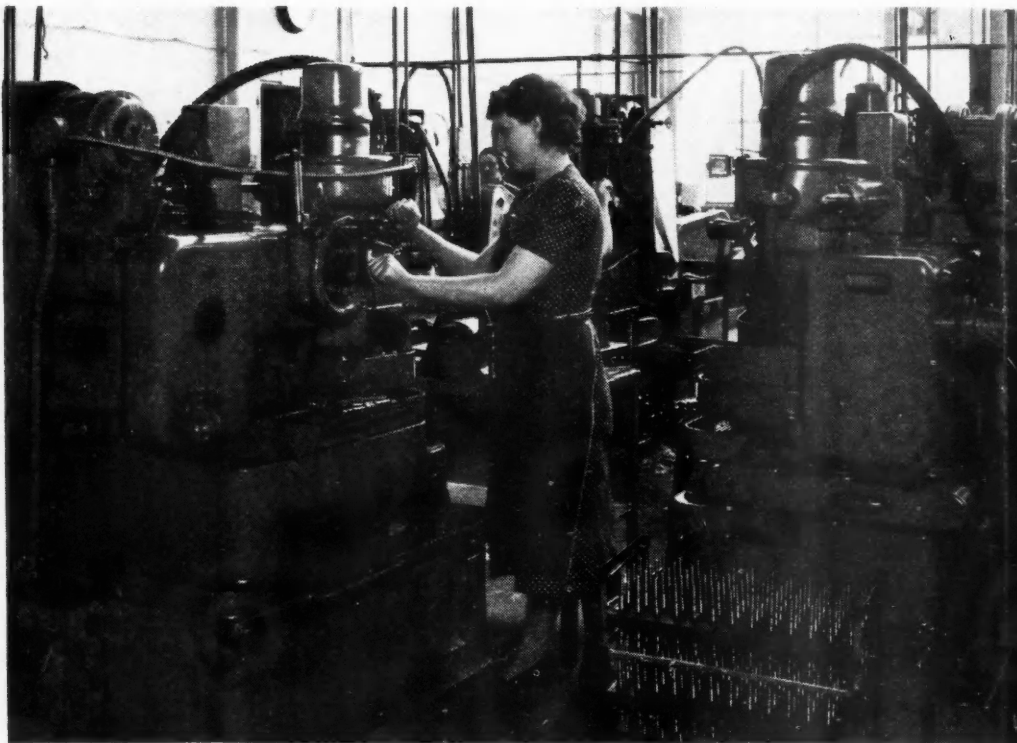


PRODUCTION

of equipment and process, AC provides an example of fresh and virile approach. In the past four years, there has been a steady growth and improvement, culminating in a complete re-vamping of all production departments under the leadership of the new general manager, L. C. Goad. Major operations of the company center in the huge establishment in Flint, comprising a total of six different plants, encompassing some 900,000 sq. ft. of intensively used floor space.

Noteworthy, too, is the fact that the manufacturing equipment represents the product of scores of outstanding producers in their specialized fields—in machine tools, tool room machinery, heat treating equipment, materials handling devices, specialties and ovens for the ceramics division, etc. While the limitations of space make it impossible for us to cover more than a few of the high spots, we wish to give due credit to those manufacturers who have contributed to the facilities described in this study.

In addition to the productive facilities at Flint, AC products for distribution in Canada are manufactured in St. Catharines, Ontario. At Dunstable, England, there is the AC Sphinx Sparking Plug Co. (they call



*Here is part of battery of high speed Fellows gear shapers used for cutting serrations on the end of hardened governor shafts.*

*(Right) Part of the battery of Verson welded steel presses, this group producing air cleaner shells.*

them sparking plugs over there), supplying the British trade. Still another plant at Clichy, near Paris, takes care of the French industries.

If you examine any of the items made by this company, particularly in view of their comparatively low price, they appear rather simple to the eye. Yet a glimpse of the actual operation will reveal, even to the layman, a veritable maze of special techniques beautiful in their very complexity, in smoothness of performance, in their apparent simplicity.

In fact, it is this phase of the operation that will repay one for a day's journey through some 20 acres of manufacturing activity. Since the complete detail of the production set-up for but one of the 28 major products may take more than the space allotted to this entire article, we have provided a birdseye view of the entire operation by a perspective of some of the high spots, touching upon detail here and there, placing the burden of the picture on a comprehensive group of illustrations combing every corner of the plant.

Turning for the moment to some of the results of the modernization program, it will be found that much of the equipment used in spark plug manufacture is of proprietary nature, in the main designed and built by AC. Similarly, the die casting plant is equipped exclusively with die casting machines designed, patented, and built by AC both for themselves and for the market.

### **AC Spark Plug Division General Motors Corporation**

#### **Executive Plant Personnel**

General Manager .....	L. C. Goad
General Sales Manager .....	W. S. Isherwood
Works Manager .....	P. W. Rhame
Assistant Works Manager .....	J. A. Anderson
Production Manager .....	L. W. Tobin
Chief Engineer .....	C. W. McKinley
Research & Ceramic Engineer .....	T. G. McDougal
Chief Spark Plug Engineer .....	Hector Rabezzana
Comptroller .....	Eskild Bondesen
Service Manager .....	S. S. Howard
Advertising Manager .....	Earl McGinnis
Purchasing Director .....	H. R. Wells
Industrial Relations Director .....	George Mann, Jr.
Chief Inspector .....	S. N. Lyttle
Master Mechanic .....	L. H. Benson
Works Engineer .....	E. J. Kelly
Bearings and Oil Filters, Superintendent .....	Miles G. Hanson
Spark Plugs, Superintendent .....	Archie I. Skelton
Fuel Pumps, Air Cleaners & Silencers, Superintendent .....	Al J. Proctor
Die Casting, Superintendent .....	Marc Stern
Automatics, Superintendent .....	Don C. Stewart
Instruments, Superintendent .....	Lee Sherrod
Ceramics, Superintendent .....	Albra H. Fessler

Such developments are credited generously to the genius of Marc Stern, famed authority in the field of die casting and author of texts on the subject. Older die casting machines, still in use here, are air-operated. However, these are being superseded and replaced by the more modern hydraulically operated machines.

Other phases of the operation, however reveal items

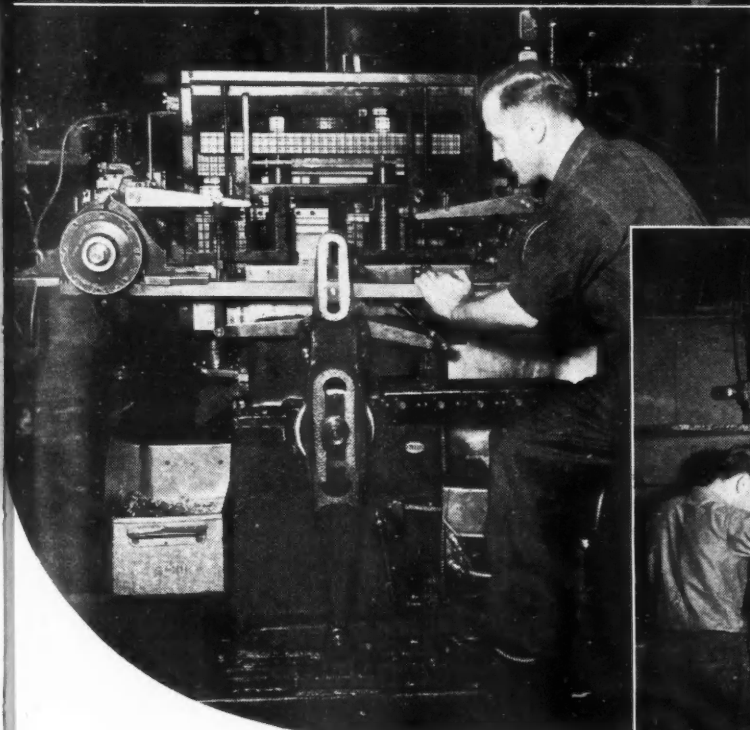
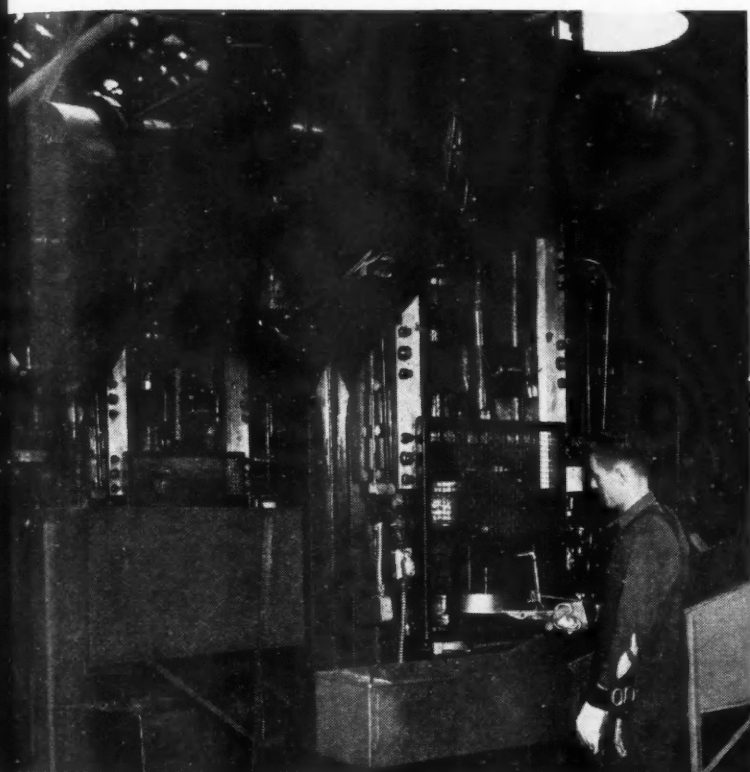
of equipment familiar in the metal working field. For example, the spark plug plant has its own self-contained automatic department equipped with National Acme-Gridley and New Britain-Gridley automatics of the latest types. The main automatic plant boasts a big battery of all manner of automatics—Acme-Gridley, New Britain-Gridley, Brown & Sharpe, Davenport.

In the press shop is equipment of many types and sizes including such makes as Bliss and Verson, also the versatile Henry & Wright dieing machines. In the machine shops we may note, among other things, the Cincinnati Centerless grinders with Danly Feedmatic automatic magazine hoppers, Kingsbury multiple head sensitive driller and tappers, small Delta drills, and many others too numerous to mention.

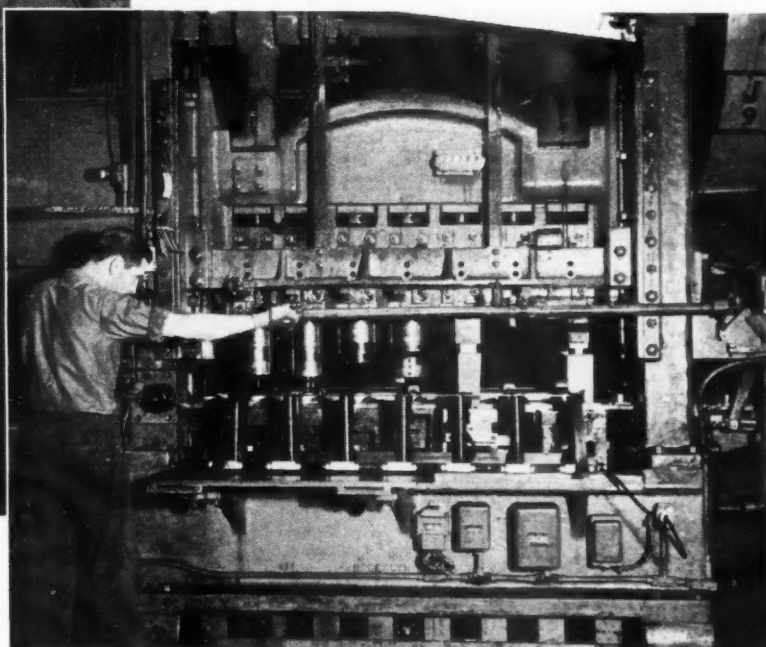
Rounding out the program of complete mechanization in the interest of a smooth flow of materials and parts, AC has developed a comprehensive system of materials handling, comprising devices of every character depending upon the nature of the specific problem. Overhead monorail conveyors for transporting parts to work stations and assembly lines, also for transporting work through spray booths and ovens and dryers; bench conveyors for assembly tables; cranes for handling heavy bundles of steel and other metals—these abound at every hand. In the press shop, an orderly routing of work, at the same time relieving the operators of the burden of handling all manner of rough stampings, is achieved by the installation of the portable belt type flight conveyors. These connect related operations between two or more presses and may be shifted freely according to the needs of the job.

Before delving into a close-up of departments

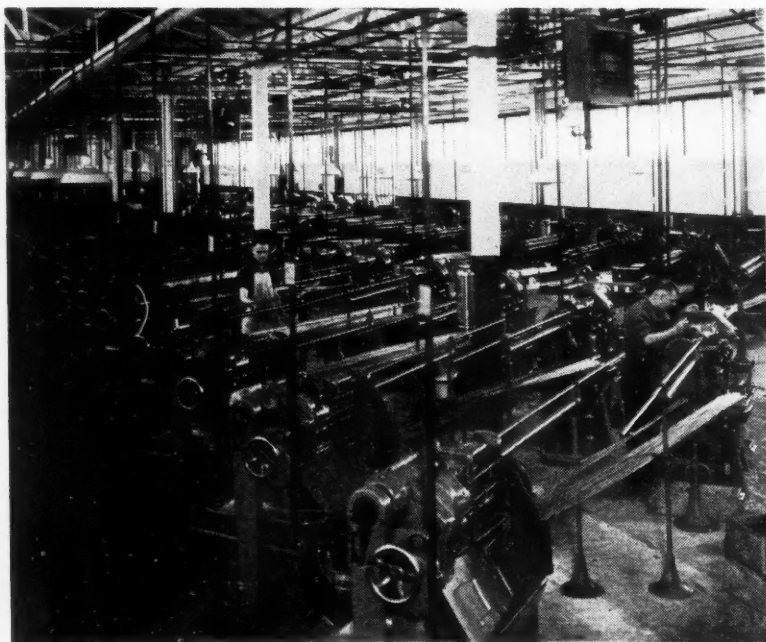
*(Below) Big Bliss press fitted with progressive die for stamping instrument cases. Unique feature of this set-up is the use of a photocell (electric eye) at each transfer station to assure perfect alignment of the work in the die.*



*Close-up of one of the battery of Henry & Wright dieing machines, this one producing fuel pump washers.*







*View of one of the two principal screw machine departments showing a group of automatics turning out instrument and fuel pump parts. AC has installed equipment built by the leading screw machine manufacturers including Acme - Gridleys, New Britain-Gridleys, Brown & Sharpe, Davenport, and others.*

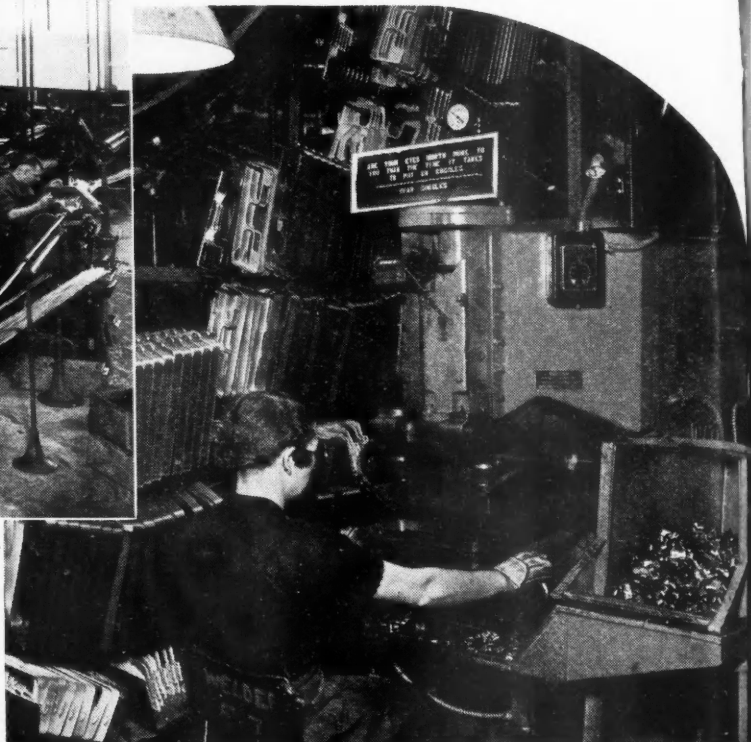
and operations, it is necessary to examine some of the background essential to an appreciation of things not so evident to the eye. In the first place, it should be noted that the orderly and economical course of producing such technical products represents the very essence of our present knowledge of metallurgy and materials. More important is that the production techniques evident at every turn are the product of a long history of specialization and research.

Consider just a few examples: The insulators used in AC spark plugs are the result of many years of intensive research. Material for insulators is obtained from widely separated parts of the earth. From 50 ft. beneath the bed of a lake in Florida an unusual kind of clay is extracted by hydraulic pumps. Other special clays come from the backyard of an ancient castle in England, and from three states in America; then there is a finely ground ingredient obtained after fusing two kinds of minerals.

The story of the electrode and side wire marks a triumph of engineering research. In developing this wire, which is known as "Iso-volt," AC engineers really created a new industry. They found that the best wire for the purpose should contain a certain amount of barium. Now barium formerly cost something like \$600 a lb., but a method of producing it was developed which slashed the cost, and made possible its use in all AC spark plugs so that now there is a factory making barium for wide commercial use.

Ammeter assembly provides an example of another kind. At assembly the fine enameled wire ends ter-

*(Below) New National welding machine used for resistance welding various brackets on instrument back plates.*



minating from the two small coils have to be soldered together for attachment to the terminal connection. For a long time it was the practice to scrape off the enamel coating laboriously by hand, ruining many instruments in the process due to breakage of wire ends. Today, the assembly table contains a number of small built-in, electrically heated and thermostatically controlled pots filled with silver solder which is main-

tained at a temperature of 1200 deg. Fahr. When the wire ends are placed in the liquid bath, the intense heat burns off the enamel and simultaneously coats the terminal with the excellent current conducting silver solder.

It will be evident from personal observations as well as an examination of the many illustrations reproduced here, that much of the mechanical and assembly work is done by female operators. In our opinion, the AC plant provides at least one excellent answer to the oft-repeated question—what is the place of women in the industry? It is unique to the business of this plant that many, if not most, operations involve the handling of extremely small, if not minute parts; require the integration of small parts into small, precision assemblies; demand dexterity and exceptional skill on high repetitive tasks. It is axiomatic that at least for such requirements, skilled women not only are desired but as a matter of fact, indispensable, since men's thicker fingers and more volatile temperament could not hope to cope with the problem.

Speaking of skills, we watched several operations which kindled our admiration for the dexterity and rhythm of the workers. For example, there are a number of stations on the spark plug assembly line where it takes at least three months to train a worker for the specific task. We observed one group, assembling spark plugs, using both hands, keeping up with the pace of the line while holding small talk with a fellow

## List of Major AC Products

Air Cleaners  
Ammeters  
Carburetor Intake Silencers  
Carburetor Intake Silencers  
and Air Cleaners  
Die Castings  
Die Casting Machines  
Flame Arresters  
Flexible Shafts and Cables  
Fuel Pumps  
Fuel and Vacuum Pumps  
Gasoline Gages  
Gasoline Strainers  
Instrument Panels  
Engine Bearings, precision,  
copper-lead, babbitt  
Locker Doors

Oil Filters  
Pressure Gages  
Radiator Pressure Caps  
Reflex Signals  
Remo Injectors and Fluid  
Spark Plugs  
Spark Plug Cleaners  
Spark Plug Testers  
Spark Plug Gapping Tools  
Speedometers  
Tachometers  
Thermo Gages  
Vacuum Pumps

worker across the line. In this case, the ability to carry on a conversation while working is a complete index of maximum efficiency.

It is safe to generalize that the whole secret of the ability to produce fine technical instruments and parts in huge quantity, at a price, may be credited to a common-sense application of that remarkable technical tool—method study—combining social purpose with economy. Its use comprehends a knowledge of the functions of the human body and its elements, an appreciation of the actions that contribute to physical fatigue, a development of mechanical aids and personal skills that promote tireless, rhythmic action.

Method study as it is practiced at AC sums up to an important social contribution, albeit one that gives the most purposeful results in operating economy. For instance, oft-times it takes several months to work out the best kind of work place for a given job—improving the height and location of a bench, developing the most convenient layout of the work station with respect to the location of tools and assembly fix-

ture, design of bins for holding component parts. As an adjunct of this work, we find the elimination of fatigue on repetitive operations, elimination of eye movement, general improvement in seeing—all resulting in the diminution of physical and nervous fatigue.

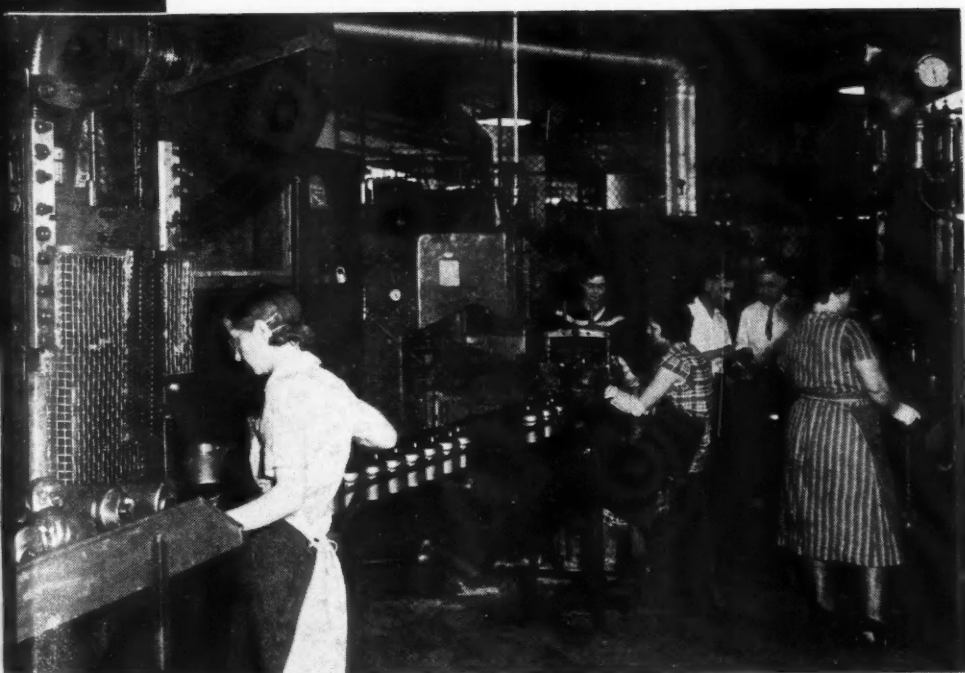
As a part of this program has grown the adoption of hopper and magazine feed for all manner of operations, facilitating the flow of parts, making it unnecessary for women to bend and lift heavy tote boxes.

### Manufacturing Departments

With the foregoing as a background, it is convenient to study the general activity in each factory department, taking them according to

*Perspective of the gasoline gage assembly line with calibration stations in the foreground.*

*(Below) Corner of one of the tight oil filter fabrication lines showing seam welding and trimming operations. Equipment includes Verson presses and National welding machines.*





plant divisions. By actual count there are 36 different departments composing the seven plants. Each of the plants is supervised by a divisional superintendent, as will be noted on the list of executives; each department in turn is supervised by its foreman.

*Plant 1* comprises the following departments—magnets and plating, flexible shafts, oil cleaners, fuel oil strainers, oil filters, signals and miscellaneous parts, precision bearings.

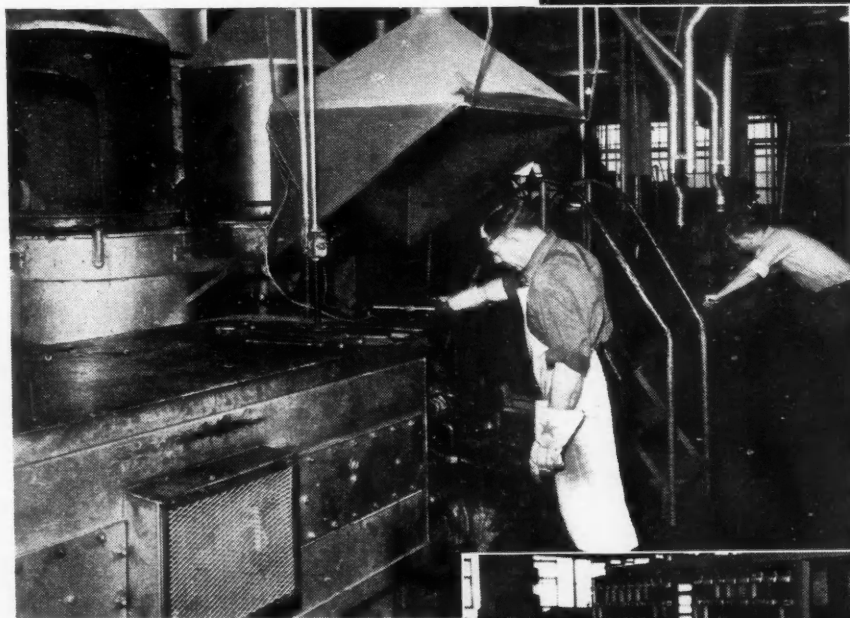
The cable department makes all of the flexible cable and casing used with AC speedometers and for radios. Here will be found equipment for transferring cable wire onto spools used on winding machines; a battery of winding machines; operation of cutting cable to gage length in which an electric eye measures to length and starts the cutting flame which also seals the cut end.

There are other operations such as

first, the production of the babbitt bearing. Stock of the required width is received in rolls, the material being cold-rolled steel, tin coated. The coils start at one end of the line, proceeding through an automatic flash welder which welds the ends of coil strips into a continuous strip directed into the entrance to a long



*Divine Bros. straight line multiple-head automatic buffing machine set up in plating department for buffing radiator side grilles.*



*(Center) Automatic babbitting station at the end of the long tunnel type heating oven for producing AC steel-back babbitt bearings. Metal alloy is supplied from the furnace at the right, coating the heated strip as it emerges from the oven.*

*(Below) Typical of quality control is this inspection station at the end of the ammeter assembly line. Every instrument is checked for calibration before shipment to the customer.*



the swaging of cable ends, assembly of ferrules, etc.

The cable casing also is made here, being wound from strip stock on special automatic machines. Final operations include assembly of fittings on the casings, greasing of cable and fitting cable into casing, preparing for shipment.

One of the most interesting departments in the entire plant is the one devoted to the manufacture of precision engine bearings. AC makes four types of steel backed bearings—for connecting rods, mains and camshaft, of babbitt, high lead, tin and copper lead, the latter for gasoline and for heavy-duty Diesel engines.

Following the process very sketchily, we can take,

tunnel oven whose function is to raise the temperature of the metal for proper bonding of the babbitt metal. A babbitting station is located at the exit end of the oven, coating the strip as it moves along.

This is followed by a succession of machining and press operations. The coated strip, first is rough-milled to approximate thickness, rolled flat, cut into blanks of proper size on a Verson punch press. These blanks then are formed into half-shell on

Verson inclinable presses, chamfered, broached individually on Foote-Burt broaching machines in preparation for finish-broaching.

The parts now are copper-plated all over, finish—  
(Turn to page 663, please)



# AUTOMOTIVE INDUSTRIES

## *Just among Ourselves*

**T**HE happy position of the engineer as a man of fact in a world rocked by illusions was outlined by W. J. Davidson, president of the Society of Automotive Engineers, in opening the Society's World Automotive Engineering Congress in New York, on May 22. Few international gatherings have been opened with less pomp. Brief speeches of welcome were in pleasant accord with Mr. Davidson's portrait of engineers, and within an hour the congress had settled down to its five days of technical fare in New York.

### Telling the Facts . . .

W. J. Cameron, Ford Motor Co., was the first of a notable series of speakers on general problems of interest to automotive engineers. In talking about "Men and Machines" he pointed out the impossibility of saying anything new on the subject, but the extreme desirability of putting the facts which are available into the hands of a larger public.

Said he: "The onus of anti-machine propaganda falls inevitably on the industrial production machine," which he pointed out is simply the creator of dozens of other machine utilities which the general public accepts with equanimity and would not be willing to do without.

Mr. Cameron remarked, rather sadly, that perhaps some of the criticism of production machinery as a supplanter of labor may date from an earlier period when industry was inclined to be boastful about technological progress. A giant new press would be announced with thumbs hooked into armpits, and maybe there was a slight tendency to magnify the actual performance of the machine.

Technological displacement of workers, according to Mr. Cameron, is accompanied by a rapid absorption of displaced workers into new industries and new services created by technological advancement.

### Visitors from Overseas

The International Automotive Engineering Congress attracted several score visitors from overseas. Most of the overseas delegates were traveling on time borrowed from plants busy with national defense preparations, and there was a certain grimness about lobby discussions of international policy. The push behind defense preparations in France and England has converted many a small parts producer into a mass production operation. But the people directly concerned are not exactly elated about it.

### Rear-Engined Cars

Although it is now nearly a decade since American engineers first became interested in the problem of a passenger car with the powerplant mounted at the

rear, and although a number of very attractive designs with this layout have been produced, no rear-engined model has yet gone into quantity production in this country. In the past we have usually looked upon the rear-mounted powerplant as advantageous because it permits of better streamlining. A passenger car streamlined for high speed must of necessity be provided with a fairly long, tapering tail, and if the car carries the conventional six- or eight-in-line engine at the front under a hood, such a tail is impractical, as it makes the car excessively long and unwieldy. But if the powerplant is located at the rear an excellent streamlined form can be achieved without undue length.

There is, however, another point of view from which the problem of the rear-engined car can be considered, and that is from the standpoint of its effect on space economy and economy of operation. A great many modern buses have the powerplant located at the rear, under a full-width cross seat, so that it occupies no space which might be utilized for seating passengers. For a given over-all length the rear-engined bus has a considerably larger carrying capacity than an old-style bus with the engine in front under a hood. It is quite evident that something of the same space economy can be effected in private passenger cars if the powerplant is located in what is now the rear luggage compartment. The spare wheel and luggage must then be provided for at the front, and if any real saving is to be effected, the luggage space must be held considerably smaller than on the average present-day car. While reduced luggage space might be considered a disadvantage, it is hardly a serious one in a car to sell at a distinctly popular price, as such cars are not used to any great extent for long-distance touring. If a long tour should be made in the car occasionally, excess baggage could be accommodated on the outside, by means of a luggage carrier, as in past years, provided the car still had running boards; and where an unusual amount of luggage had to be transported there would always be the possibility of recourse to a baggage trailer.

With the powerplant located over or close to the rear axle, a car with given inside body dimensions can be built on a shorter wheelbase than one of conventional design, and both seats can be well within the wheelbase, which will improve the riding qualities of the rear seat. Besides, shortening of the wheelbase and the over-all length of the car will have a favorable effect on both production and operating costs. It is an interesting fact in this connection that whereas some of the earliest rear-engined, streamlined cars, such as that of Sir Denistoun Burney, were of a large and pretentious type, most of the more recent rear-engined creations have been rather small and unpretentious.—H. H., P. M. H.

# At Indianapolis . . .

***half a hundred drivers are striving for supremacy at the great classic. Designers and mechanics have been cooperating for months. Here is digest of what has been accomplished***

**A**s is usually the case, with some fifty entrants for the 500-mile Indianapolis race—out of which thirty-three take part in the great event on Memorial Day—there are various schools of design. Some are dictated by the whims of drivers while others come from the drawing boards of such well-known designers as Harry Miller, Art Sparks, Riley Brett, Cotton Henning, George Lyons and others of equal note

By B. M. IKERT

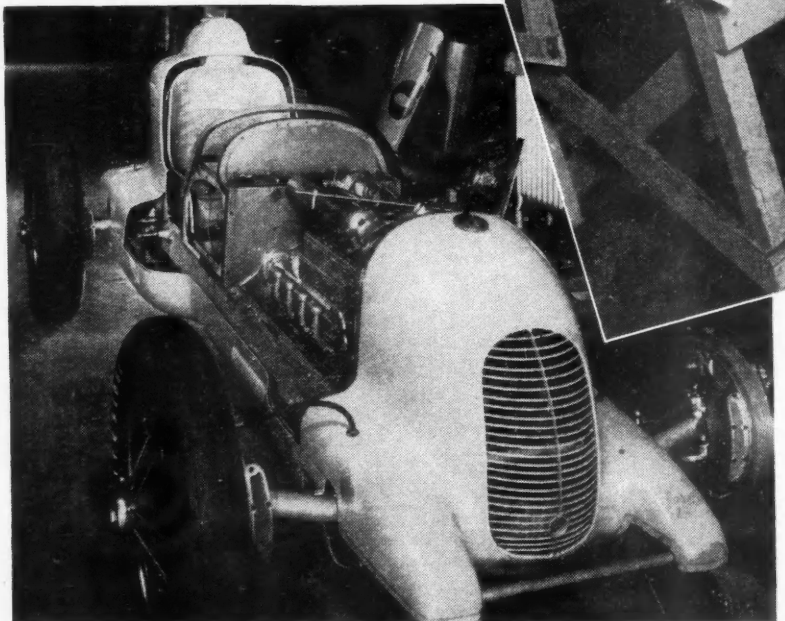
Although race car designers and builders may differ in their methods of approach, in the solution of race car design problems, it becomes evident to even the most casual observer that this year's "500" cars follow certain trends.

Of these, probably the most obvious is the betterment of the outward appearance of the cars in general. True enough, there have been some excellent body jobs in the past, like the ultra-streamlined car Wilbur Shaw drove last year. But the cars gathered for the 1939 event might well come under the head of "show models."

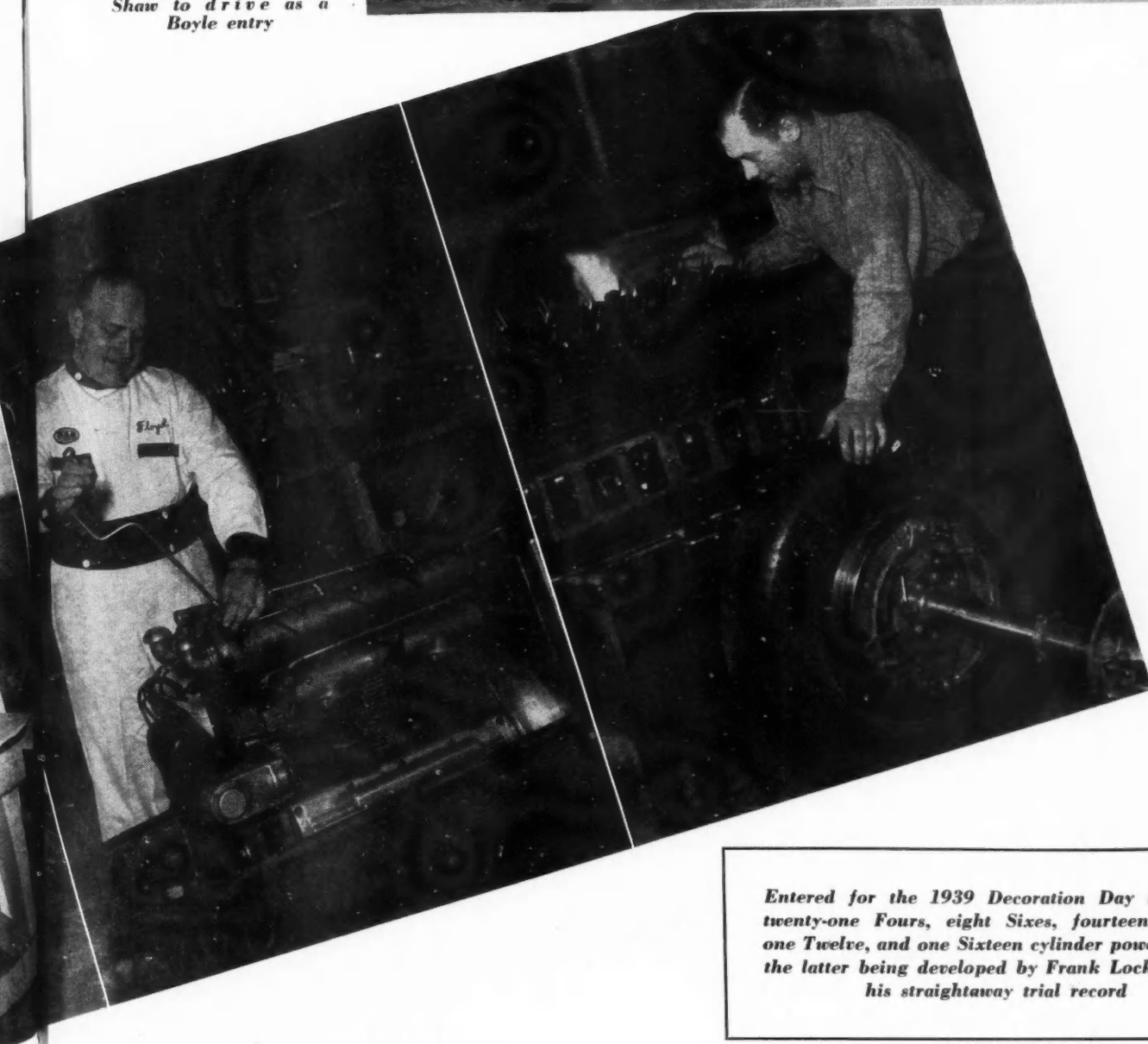
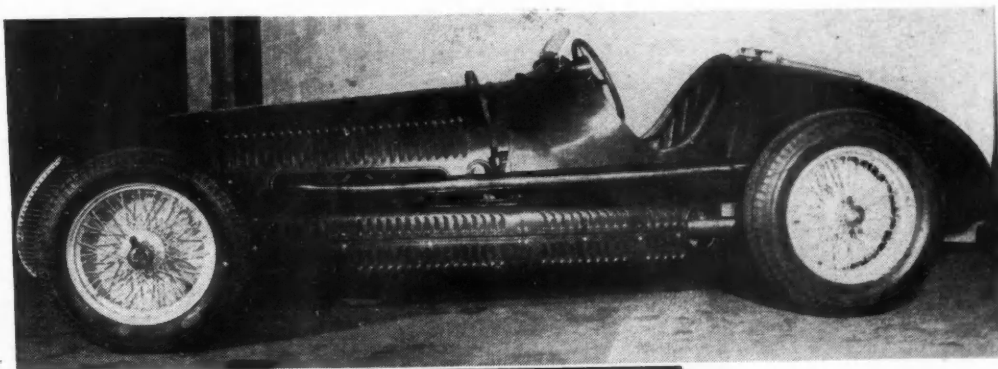
It used to be said that the cars on the race tracks of today give a hint as to what might be expected in our passenger car designs of tomorrow. But, it looks now as though race car designers and builders took a leaf from the note books of passenger car designers and very definitely have beautified their products, aside from the better performance attained by enclosures primarily designed to aid in better streamlining.

In the orthodox designs of "Indianapolis cars" a few years ago—and there still are many of them in evidence at Indianapolis this year—it was customary to bolt the cowl to the frame, attach an underpan, bolt on a tail, the fore part of which was upholstered to make a driver's seat and strap down an engine hood pretty much as with passenger cars. Plenty of brackets and obstructions were exposed in these cars, the only attempt at "streamlining" being the addition on top of the tail to

*This shows the trend in completely enclosing springs and other chassis parts. The pan extends underneath the entire car. It was built by George Lyons*



*This Maserati was brought over from Bologna recently by H. G. Henning for Wilbur Shaw to drive as a Boyle entry*



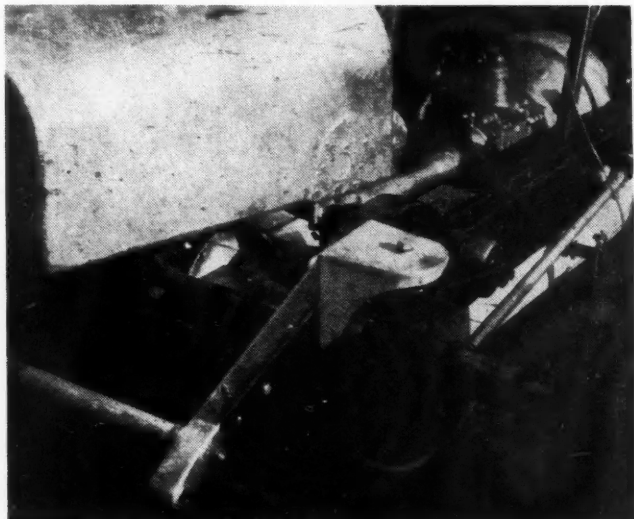
*Entered for the 1939 Decoration Day race are twenty-one Fours, eight Sixes, fourteen Eights, one Twelve, and one Sixteen cylinder power plant; the latter being developed by Frank Lockhart for his straightaway trial record*

*Above, at the left, we see Lou Meyer, who has three times caught the checkered flag, reassembling the engine on which hangs his hope for another victory. At his right is Floyd Roberts putting the finishing touches to his car in a try for a repeat of last year's victory. At Roberts' right we see Jimmy Snyder who is a favored choice for this year. While never a winner he has driven the fastest lap ever recorded at Indianapolis*

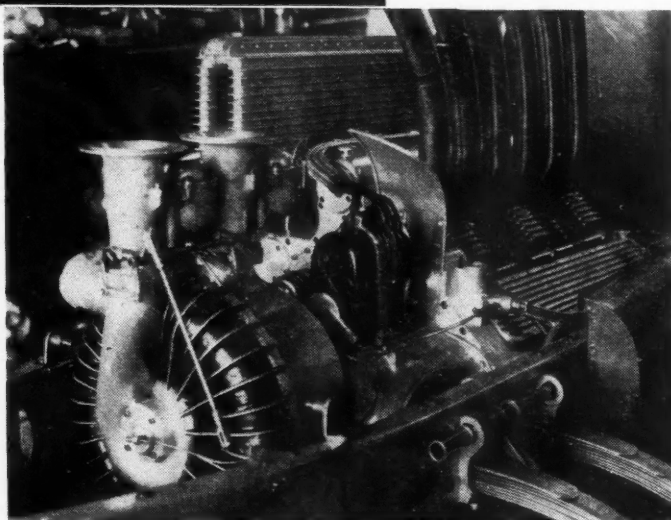
take case of the air disturbances on the driver's head.

It must be said of such cars as the Maserati of Boyle Racing Headquarters, brought to this country by Cotton Henning and to be driven by Shaw, the new Miller four-wheel drive cars, the Samson Comet, the Burd Piston Ring Specials built up by Joe Lencki and George Lyons, the Sparks-built Thorne cars and others that they are probably the most beautiful jobs ever gathered together at Indianapolis. Although the degree of streamlining and more complete enclosures





**(Above)** Coil springs used on the rear of Phil Shafer's car. Ball joints are used throughout and excellent riding qualities have been obtained from this design



**(Left)** Rear compartment details of the Miller four-wheel drive car. The engine is inclined 45 degrees. The right side fuel tank, helping to streamline the job, also is visible

is not so marked in some of the other cars, they, too, follow the trend. Notable examples of this are the Elgin Piston Pin Special, Russ Snowberger's car and Phil Shafer's Indiana Fur Co. Special.

The paint jobs of most of the cars this year rival those of the best passenger car production. No doubt the more general use of metal enclosures embodying gracefully-molded surfaces has been an incentive to get the most beautiful effect from the paint. Actually, the high-lighting of some of these surfaces produces what might be called "cheat lines" helping to make the cars look much more formidable.

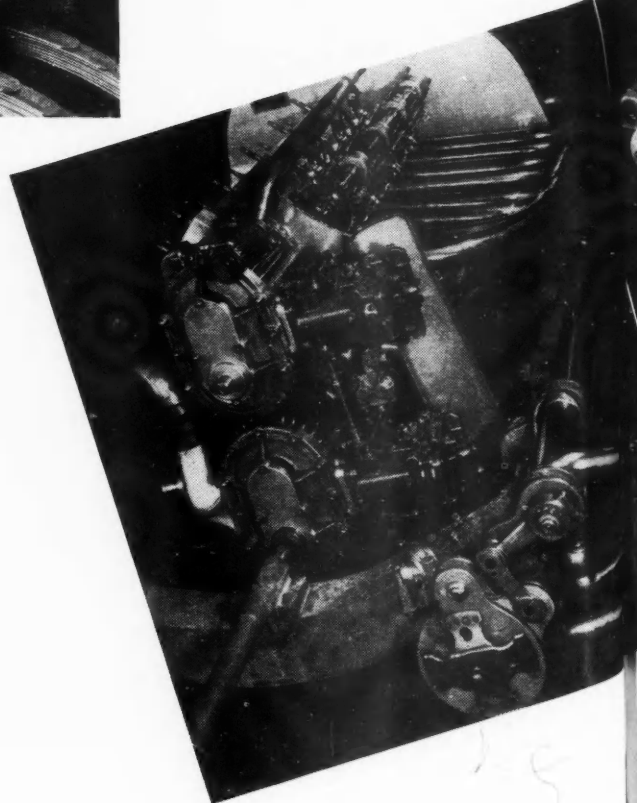
In attaining better streamlining, nuts, bolts and rivets have been eliminated by making a single member serve more than one purpose. Thus, one side of a hood may serve to enclose also the frame besides extending well under the car. Radiator shells for the most part not only cover the cores but the frame horns and much of the front end mechanism as well. Attachment usually is made from the inside and, therefore, the outside is clean cut in appearance since bolt heads are not visible.

Not only are bodies better looking and better built, but more comfortable as well. Since driver comfort is an all-important factor in a race of 500 miles, apparently much thought has been given to the subject. For one thing, instead of the usual construction

wherein the front part of the tail is padded and a cushion tucked in for the driver to sit upon, quite a few cars have individual seats entirely separate from the tail structure. The seats can be positioned for greatest driving comfort and being substantially insulated greatly cut down car body vibration so far as the driver is concerned.

Again, on the comfort side of the picture as well as from a performance factor, is found a decided tendency towards better springing. It formerly was the custom to make race car springs very stiff with the result that the cars rode very "hard." In general it might be said that this year's entrants are performing exceedingly well in that the bodies remain substantially level or "float" while most of the up and down movement or bounce is taken by the springing

and wheels. Where semi-elliptic springs or transverse springs are used they have been made noticeably flatter inducing much better riding qualities. Builders also state that much better materials



**Articulated drag link on Ted Horn's Boyle Special. The fuel pump is driven off the left camshaft. The strainer is on the opposite side**

have gone into the springs and the workmanship is of a very high order. The designers also mention that much more consideration has been given to the ratio of sprung and unsprung weight.

With the more general use of light alloys for chassis parts, fire walls and other fitments, weight has been considerably reduced allowing the builders to put more "stuff" into the power plants. However, since the gained horsepower must finally manifest itself on the wheels propelling the car it becomes evident that good springing along with proper weight distribution is very necessary to insure proper contact of the tires.

One unusual form of springing so far as race car design is concerned is that of Phil Shafer's car, driven by Louis Tomei. It incorporates coil springs at the rear somewhat on the order of the Buick passenger car design. The car rides very well and an extremely free and easy movement has been given the parts by the liberal use of ball joints on all moving arms attached to the axle or frame.

Again, in the matter of maintaining proper tire-to-track contact for maximum traction at sustained high speeds, mention must be made of comparative recent

developments that have made this possible. Right after last year's race, the Firestone company went to work on racing tire experiments. As a result the "herring-bone" tread tire is much in evidence today on race cars. Mr. John F. Moore of Firestone's development department states that this tire has helped many of the drivers to qualify at higher speeds.

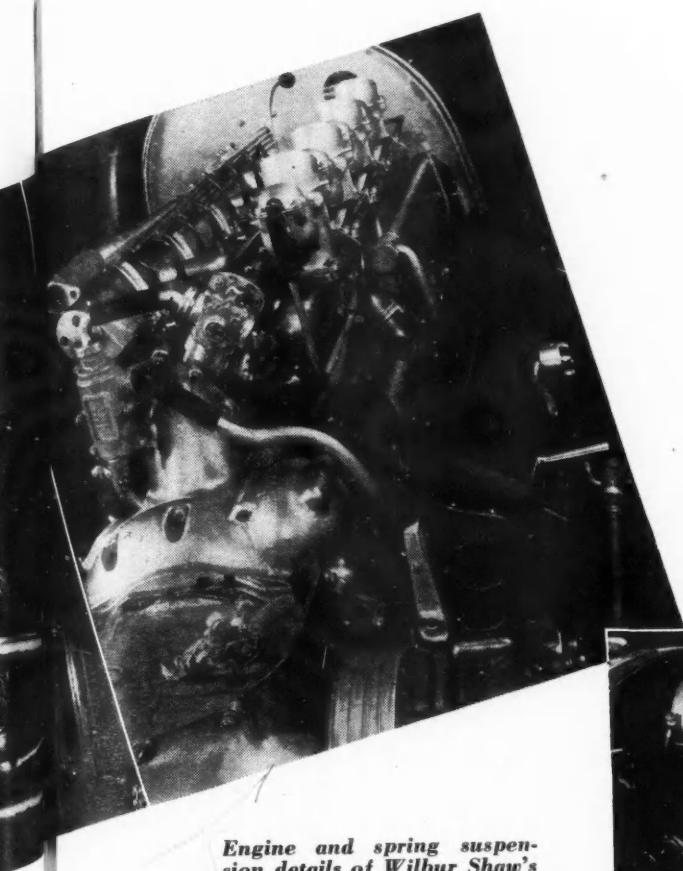
In almost all cases the tire pressure is 38 lbs. An interesting angle here is that instead of air, nitrogen gas is used for inflation. Incidentally, this is said to be a safety factor. Being an inert gas, nitrogen expands very little under heat. Opinion is prevalent that in the past cars which collided with the retaining wall and bursting a tire may have caught fire because of the sudden release of highly compressed and heated air in the presence of fuel that may have become spilled. Nitrogen is dispensed at the speedway by Firestone from cylinders made up of cells and carrying 2200 lb. pressure per square inch. Twenty-five to thirty-five tires are inflated by each cylinder.

In some cars like the Lencki-built and Lyons-built Burd Piston Ring Specials the underpans cover the entire bottom of the car helping not only in the matter of streamlining, but adding a certain amount of safety by tipping off during trial runs any part not functioning properly. Thus, any leakage is quickly detected because of oil, or whatever else, in the pan.

Excepting for the novel braking on the rear wheels of the Lencki car, as well as the disk brakes of the Miller four-wheel drive jobs, brakes remain the same as last year. Naturally, the brakes of the foreign Maserati and Alfa-Romeo models are very large since much "cornering" is done in European events.

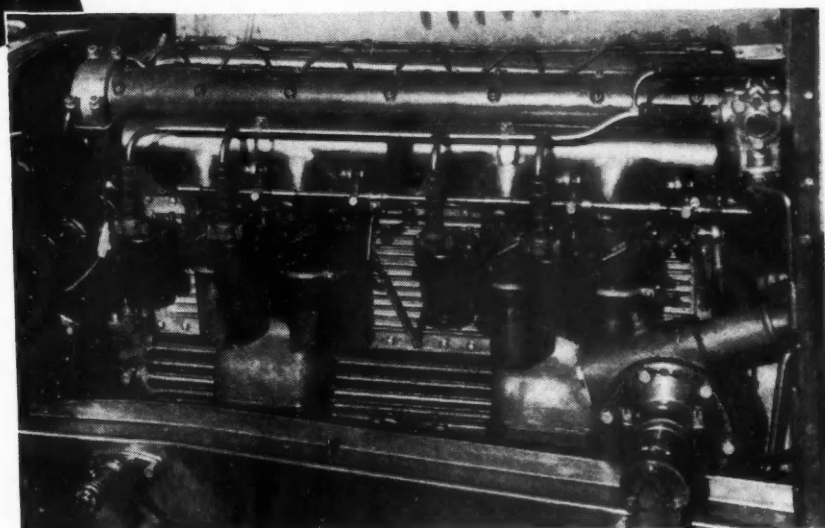
An interesting point regarding the Milan disk-type brake on the Lencki job is the fact that the two brakes on the rear weigh some 30 lb. less than the conventional show type used on most Indianapolis cars. The brakes are operated by cable and in design are the reverse of a conventional clutch. The revolving part is a thin disk of metal faced with friction material running between two alloy disks lined with gunnite.

Not so long ago down-draft carburetion was the vogue in race cars at Indianapolis. This year, however,



*Engine and spring suspension details of Wilbur Shaw's Boyle Special. This shows the torsion bar manner of springing the car. The horizontally mounted carburetors differ from conventional American practice*

*(Right) Engine details of Joe Thorne's car. Carburetors are mounted at an angle to the center line of the engine*



## Indianapolis Entrants

Car No.	Name	Driver	Engine	Make	No. Cylinders	Bore	Stroke	Displacement	Supercharged	Spark Plug	Ignition	Ignition Cable	Piston Rings	Carb.	Wheel Suspension	Shock Absorbers	Qualifying Time	Rear Axle Gears	Car No.		
1	Burd Piston Ring Spl.	Floyd Roberts.	O	4	4.312	4.625	270	N	Y	C	B	P	B	2	W	R	1904	126.998	DD	1	
2	Boyle Spl.	Wilbur Shaw.	M	8	2.652	3.900	178.1	Y	N	M	S	B	B	2	W	R	1898	128.977	Ma	2	
3	Boyle Spl.	Chet Miller	O	4	4.250	4.500	255	N	N	C	B	P	PC	2	W	R	1856	126.316	DD	3	
4	Boyle Spl.	Ted Horn	M	8	3.375	3.750	268	N	N	C	B	P	PC	4	W	R	1945	127.723	DD	4	
7	Belanger Spl.	Duke Nalon.	M	8	3.375	3.750	268	N	N	C	B	P	PC	4	W	R	1985		DD	7	
8	Thorne Eng. Spl.	Joe Thorne	S	6	3.535	4.625	271.8	N	N	C	B	P	PC	4	W	R	2050	122.117	DD	8	
9	Miller-Hartz Spl.	H. Ardinger.	M-H	8	2.875	3.500	181.6	Y	Y	C	B	P	PC	1	S	R	1903	124.125	DD	9	
10	Thorne Eng. Spl.	J. Snyder.	S	6	3.203	3.750	182	Y	Y	C	B	P	PC	1	W	R	2002	130.138	DD	10	
12	Marchese Spl.		M	8	2.875	3.500	181.6	Y	Y	C	B	P	PC	1	W	R	1873		DD	12	
14	Burd Piston Ring Spl.	F. Wearne.	M-O	4	4.500	4.250	270	N	N	C	B	P	B	2	W	R	1856	125.074	DD	14	
15	Thorne Eng. Spl.	Rex Mays	S	6	3.203	3.750	181.1	Y	Y	C	B	P	PC	1	W	R	2010	126.413	DD	15	
16	Wheeler Spl.	Mauri Rose...	O	4	4.260	4.500	256.4	N	N	C	B	P	PC	2	W	R	1791	124.896	DD	16	
17	Miller Spl.	Geo. Bailey	M*	6	3.500	3.125	180.3	Y	Y	C	S	P	PC	2	M	FWD	2102	125.821	DD	17	
18	Marks Spl.	Geo. Connor	O	4	4.250	4.500	255	N	N	C	B	P	PC	2	M	R	1921	123.208	DD	18	
21	D-X Spl.	R. Snowberger	M	4	4.280	4.500	258.8	N	N	C	B	P	PC	2	W	F	1956	123.199	DD	21	
23	W. A. Spl. Rotary Valve		W-A	4	3.687	4.250	181.2	Y	Y	C	B	P	PC	1	S*	R	1921		H	23	
25	Hamilton-Harris Spl.	R. Hepburn	O	4	4.312	4.625	270	N	Y	C	B	P	P	PC	1	W	R	1970	122.204	DD	25
26	Barbasol Spl.	Billy De Vore.	D	4	3.812	4.000	182.8	Y	Y	C	B	P	PC	1	W	R	1890	116.527	DD	26	
27	Miller Spl.	Zeke Meyer	M*	6	3.500	3.125	180	Y	Y	C	S	P	PC	2	M	FWD	1920	123.351	DD	27	
28	Deacon Litz Spl.	Geo. Robson.	Ma	V-8	3.308	3.937	270.5	N	N	C	B	P	PC	4	L	R	1873	116.305	DD	28	
29	National Seal Spl.	Frank Brisko.	B	6	3.635	4.375	271	N	Y	C	B	P	PC	3	W	F	1920	123.351	DD	29	
31	Alfa Romeo.	Babe Stapp	A	8	3.000	3.200	180.8	Y	Y	C	B	P	PC	2	We	R	1863	125.000	DD	31	
32	S. M. I. Spl.	R. Swanson	Sa	16	2.187	3.000	183	Y	Y	C	B	P	A	2	W	R	2140	129.431	DD	32	
33	Kimmel Spl.	T. Hinnershitz	V	12	2.750	3.703	263.7	N	Y	C	B	P	PC	6	H	R	1845		DD	33	
35	Kay Jewelers Spl.	Kelly Petillo	O	4	4.312	4.625	270	N	Y	C	B	P	B	2	W	R	1948	123.660	DD	35	
36	Quillen Refrigerator Spl.	Doe Williams	M	4	4.250	4.750	269.6	N	Y	C	B	P	P	PC	2	W	F	1991		ITM	36
37	Greenfield Super Serv.	Ira Hall	St	8	3.187	4.250	271.2	N	Y	C	B	P	PC	4	W	R	2040	121.188	F	37	
38	Elgin Piston Spl.	H. McQuinn.	B	6	3.625	4.375	270.6	N	Y	C	B	P	P	PC	3	W	R	1891	117.287	DD	38
39	Cheesman Maserati	Henry Banks.	Ma	8	2.930	3.025	182.2	Y	Y	C	B	P	PC	1	We	R	1984		DD	39	
41	Bill White Spl.	G. Barringer	O	4	4.000	4.250	228	N	Y	C	B	P	P	PC	2	W	R	1720	120.935	DD	41
42	Kennedy Tank Spl.	Al. Miller	O	4	4.250	4.375	269.6	N	Y	C	B	P	P	PC	2	W	R	1961	123.233	DD	42
43	Kohlert's Miller Spl.		M	8	2.555	3.500	154.7	Y	Y	C	B	P	P	PC	1	W	R	1827		DD	43
44	Chicago Flash	Emil Andres.	O	4	4.250	4.500	255	N	Y	C	B	P	P	PC	2	W	R	2096	121.212	DD	44
45	Bowes Seal Fast Spl.	Louis Meyer	B*	8	2.968	3.250	179.8	Y	Y	C	B	P	P	PC	2	W	R	2044	130.067	DD	45
47	Automotive Service Spl.	Shorty Cantlon	O	4	4.312	4.500	262	N	Y	C	B	P	B	2	T	F	1876	125.567	DD	47	
49	Joe Thorne Spl.	Mel Hansen	O	4	4.260	4.750	270	N	Y	C	B	P	P	PC	2	W	F	2110	121.693	DD	49
51	Burd Piston Ring Spl.	Tony Wilman	Lencki	6	3.750	4.000	270	N	Y	C	B	P	B	4	S**	R	1946	122.771	DD	51	
53	Maserati	Deacon Litz.	Mas	8	3.317	2.625	181.4	Y	Y	C	S	P	PC	2	S*	R	1836	117.979	DD	53	
54	Offenhauser Spl.	Cliff Bergere	O	4	4.312	4.625	270	N	Y	C	B	P	P	PC	2	W	F	1986	123.835	DD	54
55	Indiana Fur Spl.		Buick	8	3.250	4.125	273.6	N	Y	C	B	P	P	PC	4	W	R	1864		DD	55
56	W. R. W. Spl.	Floyd Davis.	O	4	4.250	4.500	255	N	Y	C	B	P	P	PC	2	W	R	2074	119.375	DD	56
58	Alfa Romeo.	Louis Tomei.	A-R	8	3.267	3.937	263.6	N	Y	C	B	P	O	PC	2	We	R	1850	118.425	DD	58
59	Woestman-McDowell S.	Louis Webb.	McD	4	4.072	4.750	247.2	N	Y	C	B	P	P	PC	2	W	R	1864		DD	59
62	Burd Piston Ring Spl.	Tony Gulotta.	O	4	4.283	4.500	258.8	N	Y	C	B	P	B	2	W	R	1868	121.749	DD	62	

ABBREVIATIONS:

Engine Make

O—Offenhauser

M—Miller

M\*—Miller, rear engine

M-H—Miller-Hart

McD—McDowell

Mas—Maserati

S—Sparks

B—Brisko

Sa—Sampson

St—Studebaker

B\*—Bowes Seal Fast

WA—Wehr-Andersen

D—Duray

V—Voelker

Supercharged

Y—Yes

No Spark Plug

C—Champion

M—Maserati

B—Bowes

Ignition

B—Bosch

S—Scintilla

Ignition Cable

P—Packard

O—Okonite

Piston Rings

B—Bu d

M—Maserati

PC—Perfect Circle

A—American Hammered

G—Goetz

Carburetor Make

W—Winfield

Me—Memini

M—Miller

S—Stromberg

We—Weber

T—Timian

S\*—Solex

S\*\*—Speed

L—Linkert

H—Holly

S\*\*\*—Special

Drive

F—Front

FWD—Four Wheel Drive

R—Rear

Wheel Suspension

C—Conventional

Ind—Independent

Starter

B—Bosch

H—Handerank

D—Delco

S-E—Special Electric

D-R—Delco-Remy

AC—Air Crank

C—Cartridge Type

A-L—Auto-Lite

Shock Absorber

H—Houde

H-H—Houde-Hartford

Hart—Hartford

M—Miller

M\*—Maserati

H-F—Houde-Friction

N—None

D—Delco

F—Friction

F-H—Friction Hydraulic

Brakes

H—Hydraulic

M—Mechanical

M-H—Mechanical, front

Hydraulic, rear

Fuel

A—Alcohol

S—Shell

EA—Ethyl Alcohol

G—Gulf

G-N—Gulf No-Nox

A-G-B—Alcohol, Gulf, Benzol blend

S-F—Super Flash

Stand—Standard

Gi—Gilmore

CF—Crystal Flash

Oil

S-L—Sta-Lube

O—Oilmum

G—Gulf

P—Pennonil

C—Castor

R-F—Ring-Free

Rear Axle Gears

DD—Double Diamond

Ma—Maserati

F—Ford

## ABBREVIATIONS:

Engine Make  
O—Offenhauser  
M—Miller  
M\*—Miller, rear engine  
M-H—Miller-Hart  
McD—McDowell  
Mas—Maserati  
S—Sparks  
B—Brisko  
Sa—Sampson  
St—Studebaker  
B\*—Bowes Seal Fast  
WA—Wehr-Anderson  
D—Dury  
V—Voelker  
Supercharged  
Y—Yes

N—No  
Spark Plug  
C—Champion  
M—Maserati  
B—Bowes  
Ignition  
B—Bosch  
S—Scintilla  
Ignition Cable  
P—Packard  
O—Okonite  
Piston Rings  
B—By d  
M—Maserati  
PC—Perfect Circle  
A—American Hammered  
G—Goetz

## Carburetor Make

W—Winfield  
Me—Memini  
M—Miller  
S—Stromberg  
We—Weber  
T—Timian  
S\*—Solex  
S\*\*—Speed  
L—Linkert  
H—Holly  
S\*\*\*—Special

## Drive

F—Front  
FWD—Four Wheel Drive  
R—Rear

## Wheel Suspension

C—Conventional  
Ind—Independent  
Starter  
B—Bosch  
H—Handrank  
D—Delco  
S-E—Special Electric  
D-R—Delco-Remy  
AC—Air Crank  
C—Cartridge Type  
A-L—Auto-Lite  
F—Ford  
Shock Absorber  
H—Houdie  
H-H—Houdie-Hartford  
Hart—Hartford

M—Miller  
M\*—Maserati  
H-F—Houdie-Friction  
N—None  
D—Delco  
F—Friction  
F-H—Friction Hydraulic  
Brakes  
H—Hydraulic  
M—Mechanical  
M-H—Mechanical, front  
Hydraulic, rear  
Fuel  
A—Alcohol  
S—Shell  
EA—Ethyl Alcohol  
G—Gulf

G-N—Gulf No-Nox  
A-G-B—Alcohol, Gulf, Benzol blend  
S-F—Super Flash  
Stand—Standard  
Gi—Gilmore  
CF—Crystal Flash  
Oil  
S-L—Sta-Lube  
O—Oilzom  
G—Gulf  
P—Pennoil  
C—Castor  
R-F—Ring-Free  
Rear Axle Gears  
DD—Double Diamond  
Ma—Maserati  
F—Ford

there is a strong trend for the up-draft variety and from the performance of the engines so equipped one is inclined to believe that the up-draft method has all of the advantages of the down-draft with none of the disadvantages such as difficulty in starting after the engine has been shut off and fuel tends to drip into the manifolds. The Lencki car engine shows another innovation this year by virtue of the horizontal type carburetors used. The carburetors, furthermore, have have no adjustments.

Owing to the high compression ratios used in most of the engines—some as high as 15, it is said—piston rings have largely gone from  $\frac{1}{8}$  in. thickness to  $\frac{3}{32}$ . The radial width also has been substantially increased from about 0.183 to 0.200 in. Naturally this is done for better heat dissipation.

In observing the engines, one sees the use of one-piece spark plugs as against the usual two-piece racing type plug. The extremely high compression ratios no doubt have much to do with this as leakage, should it occur with a two-piece plug, would mean almost certain disaster to the cylinder in which it occurred. Quite a few engines are using the one-piece plug this year and whether or not this is a trend will be better

known possibly by another year.

High compression ratios also have done much towards the more general adoption of starting motors. Being operated by a number of batteries a powerful turning effort is imparted to the engine crankshaft not possible by hand methods. Hand cranking is still in evidence, however, but with the trend towards multiple cylinder jobs it seems certain that it is on the way out.

There is nothing radically new in steering with the possible exception of the articulated drag link used in one of the Boyle Specials. The construction does away with the use of an exceedingly long drag link. Little steering difficulty is being encountered by the drivers because the axles and wheels of their cars are corrected for proper alignment before they attempt high speeds on the track.

With the possible exception of one entry all cars are using spiral bevel gears in the rear axle. The exception applies to an older model equipped with straight tooth gears. A rather interesting fact presents itself in the matter of axle gears of the Indianapolis cars in that the gears, excepting for ratio, are identical with those made for passenger car purposes.



# OLDSMOBILE SIX-CYLINDER

## 90 HP. ENGINE

### *Longitudinal and Transverse Sections*

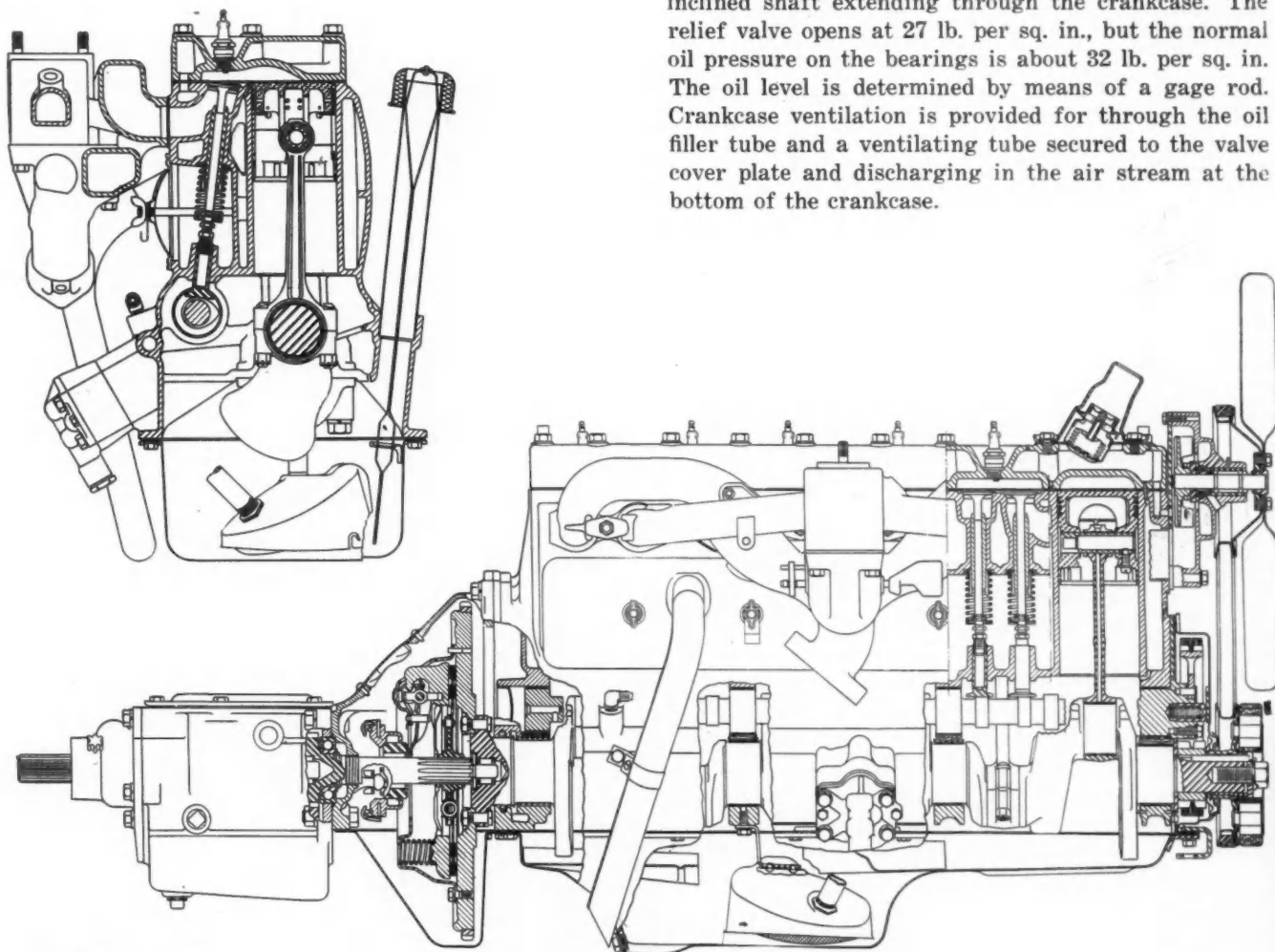
**T**HE engine of the Oldsmobile Six has a bore of  $3 \frac{7}{16}$  and a stroke of  $3 \frac{3}{8}$  in., which makes its displacement 216 cu. in. With a compression ratio of 6.2 it develops 90 hp. at 3200 r.p.m. The maximum torque of 170 lb.-ft. is developed at 1600 r.p.m. At a speed of 1000 r.p.m. the compression pressure is 151 lb. per sq. in.

The engine has its cylinder block and crankcase cast in a single unit and the water jackets extend the full length of the cylinders. The inlet valves have a 30-deg. seat and a head diameter of 1.56 in., while the exhaust valves have a 45-deg. seat and a head diameter of 1.42 in. The valve timing is as follows: Inlet opens 5 deg. before top center and closes 30 deg. after bottom center; exhaust opens 50 deg. before bottom center and closes 5 deg. after top center. Pistons are

of aluminum alloy with an anodized finish and weigh 17 oz. in the finished state (without rings and piston pin). There are two  $\frac{1}{8}$ -in. compression and two  $\frac{3}{16}$ -in. oil rings on each piston. Camshaft drive is by a toothed chain.

The crankshaft is supported in four main bearings and is provided with integral counter weights. Dimensions of the main bearings are as follows (front to rear):  $2 \frac{31}{64}$  by  $1 \frac{19}{32}$ ;  $2 \frac{35}{64}$  by  $1 \frac{1}{2}$ ,  $2 \frac{43}{64}$  by  $1 \frac{1}{2}$ ;  $2 \frac{11}{16}$  by  $1 \frac{11}{16}$  in. Connecting rod bearings are  $2 \frac{1}{8}$  in. in diameter by  $1 \frac{3}{8}$  in. in length. Connecting rods have a center-to-center length of  $7 \frac{13}{16}$  in., which is 1.91 times the length of stroke.

Lubrication is by pressure to all main, connecting-rod, piston-pin and camshaft bearings. Oil is put under pressure by a gear pump mounted outside the crankcase and driven from the camshaft through an inclined shaft extending through the crankcase. The relief valve opens at 27 lb. per sq. in., but the normal oil pressure on the bearings is about 32 lb. per sq. in. The oil level is determined by means of a gage rod. Crankcase ventilation is provided for through the oil filler tube and a ventilating tube secured to the valve cover plate and discharging in the air stream at the bottom of the crankcase.



# World Automotive

**O**N MONDAY, May 22, in New York, the Society of Automotive Engineers inaugurated its second World Automotive Engineering Congress with five days of technical programs. On May 29 and 30 the Congress adjourned to Indianapolis to participate in the pre-race banquet of the Indianapolis Section, S.A.E., and to view the annual 500-mile sweepstakes on Memorial Day. May 31, in Detroit, began a round of plant visits and production sessions for those attending. Moving westward the Congress reconvenes in San Francisco on June 6 for three days of technical sessions not duplicating those held in New York. The

complete program includes more than 60 technical papers and addresses. Among the authors are more than a score of European technicians who came to the United States especially to attend the Congress and present papers. From the proceedings of the Congress, AUTOMOTIVE INDUSTRIES has selected for digesting, those papers which seem of the most general interest and most closely related to internal combustion design problems. The first series of digests follows this note. Briefs of other papers will appear in the issue of June 15, together with a summary of newsworthy events at the Congress.

## Injection Systems of Oil Engines

**P**ROFESSOR S. J. DAVIES AND E. GIFFEN, who have been carrying out research work on fuel injection at King's College, London, for a period of nine years, gave a resume of this work and the conclusions drawn therefrom in a paper entitled "Processes in Injection Systems of Oil Engines." Reports on the work done by these two investigators have appeared in *The Automobile Engineer*, the *Journal of the Institution of Automobile Engineers* and in *Engineering*, and abstracts of these reports have been published in AUTOMOTIVE INDUSTRIES as they appeared.

The authors, in concluding their paper, remarked that in recent years circumstances have tended to separate the work of the engine designer from that of the specialist in fuel-injection equipment. While friendly cooperation exists between them, the tendency has been for the engine designer to leave problems of the processes in injection systems too much to the specialist, and decisions concerning the injection equipment, while based on sound advice from the specialist, have been largely matters of trial and error by the designer. With modern means of measurement, the supplier of fuel-injection equipment is in a position to obtain complete knowledge of the injection characteristics of the equipment he supplies. The engine designer should demand full information concerning these characteristics, so that, when making changes during the development of a particular design, he will be in a position to correlate the injection characteristics with the resulting engine performance.

Their tests led the authors to the following conclusions (among others) as to the performance of the conventional fuel-injection system consisting of a pump, a delivery valve, a pipe, and a spring-loaded injection valve:

The order of the residual pressure prevailing in the pipe between injections, relative to the nozzle-opening pressure is of vital importance.

Opening and closing pressures generally are in proportion to the effective area of the open nozzle valve and the area exposed to the oil pressure when the valve is closed.

The action of the volumes of oil (a) in the pump and (b) at the nozzle, in addition to that in the pipe, is to modify considerably the pressure diagram calculated from simple reflections in the piping. The former slows up the pump delivery characteristics, while the latter slows up the rise or fall of pressure at the nozzle and thus modifies the injection characteristics.

Injection lag may consist of three periods: That for the passage of a disturbance along the pipe; that for the building up of pressure at the nozzle, and that for the opening of the valve, of which the last two are shorter the higher the residual pressure.

Leakage from the system causes a fall of residual pressure between injections, thus affecting nozzle lag. It is not marked in the usual systems when in good order.

Increase of pump speed increases the injection angle, increases the maximum nozzle pressures, modifies total injection lag, increases the valve lift, and gives a sharper cut-off.

Rough running caused by alternating injection characteristics is common, and the pump and injection setting for normal running should avoid such instability. "Eight-stroking" when idling should similarly be avoided.

Increased nozzle opening pressures lead to increased nozzle lag, higher pressures throughout injection,

# Engineering Congress

## *of the SAE summarizes progress in 61 papers with 18 presentations by European engineers*

smaller needle lifts, greater liability to needle chatter, and cyclic variation at low speeds, smoother pressure curves at higher speeds, earlier closing of nozzle-valve, and generally better atomization and penetration.

Limiting the lift of the nozzle-valve to a value just above that causing "throttling," leads to higher pressures during the main part of the injection, and may give better atomization and penetration.

The weight of the nozzle-valve is of negligible importance. Friction of the nozzle parts normally has little influence on the process.

Increased pipe diameter causes flatter pressure waves, and these, at low speeds, cause greater nozzle lag. At higher speeds this increased nozzle lag is offset by higher residual pressures in large pipes. Too small a diameter, by increasing frictional resistances, causes excessive loss of pressure at the nozzle. Intermittent

action is more likely from the steepness of the initial waves and the smaller nozzle pressure after flow begins.

Large nozzle diameters give low residual pressures and thus greater nozzle lag. Too small a nozzle prolongs injection considerably, especially with high speeds and high nozzle opening pressures.

Very long pipes cause lower values of pressure after nozzle opening, since the reflected waves, which assist in building up the pressures, arrive late. Pipe lag increases with increasing speed. Generally, it may be said that pipes should be as short as possible for greater efficiency.

The use of a pressure release valve leads to steadier injection, reduced pressure fluctuations, and sharper cut-off at the end of injection. It may lead to an increased injection lag.

## **Modern European Light Cars**

**T**HE number of automobile manufacturers in France decreased from 45 in 1927 to 15 in 1937, according to Charles B. Brull, who read a paper on the above subject. Three French firms—Renault, Peugeot and Citroen—divide between them about 75 per cent of the total production. Mass-production methods apparently have not gained nearly the foothold in France that they have in the U.S.A., for Mr. Brull stated that the production of an average passenger car called for the expenditure of 75 man-days in France, as compared with 25 man-days here.

France so far has felt no need for roads specially built for and reserved to motor traffic, such as the auto strada of Italy and the Autobahnen of Germany. During Napoleon's reign numerous arterial, wide, tree-lined roads were built in France, comprising many straight sections miles in length. These roads during the early years of the motor era drew to France numerous motorists of different nationalities, as on such roads high speeds could be maintained without undue

risks. In the northeastern section of the country practically all of the roads had to be rebuilt after the war. In the reconstruction of these roads, modern methods were employed, and the good-roads campaign thus inaugurated was extended to the whole French road system. Many of the French roads now have dustless surface layers of bituminous tar, compressed asphalt, and bituminous concrete. However, the heavy traffic into and out of Paris, through a densely populated suburban district, has led to plans for special motor highways, some of which already are partly finished and include subterranean sections. These arterial motor highways naturally will have no level crossings. Whereas in Germany the special motor highways have permitted of an increase in the average speed of travel of 70 per cent, and of a decrease in fuel consumption of 40 per cent, such great gains could not be expected from motor highways in France, as the existing French highway system is of a high degree of excellence.



While the excellent condition of the roads has been a boon to the French automobile industry, the latter has been handicapped, particularly in recent years, by the fiscal situation. It is quite true that the annual tax on automobiles was rescinded a few years ago, but the resulting loss in taxes was made up by increases in the fuel tax. During the year 1938 the fuel tax was increased three times, with the result that the use of both private and commercial vehicles has decreased. The use of the latter, moreover, has been unfavorably influenced by the Road-and-Rail Coordination Act, the object of which seemed to be to help pull the nationalized railroads out of their financial difficulties, at the expense of the motor-hauling and motor-truck industries. The tax on gasoline amounts to 164 per cent of the cost of the untaxed fuel in France, as compared with 66.6 per cent in England and 37.5 per cent in the U.S.A. This high rate of taxation accounts for the fact that automobile production in France has been practically stationary during the past three or four years, during each of which approximately 200,000 cars were turned out. The three increases in the tax on fuel in 1938, to which reference has been made already, increased fuel costs by 34 per cent in the case of motorists using first-grade gasoline, 43 per cent in the case of those using second grade, and 64 per cent in the case of those using Diesel fuel.

The use of charcoal gas as a motor fuel is encouraged by the tax policy of France, and a number of French manufacturers have equipped passenger cars

with gas generators. One U.S. gallon of gasoline is the equivalent of 12.5 lb. of charcoal. A disadvantage of this fuel is that the power output of the engine is reduced by more than 30 per cent, because a chemically correct mixture of air and generator gas contains 33 per cent less heat energy than a similar mixture of air and gasoline vapor, and the mass of mixture taken in is less by about 17 per cent, owing to the higher mixture temperature, the greater resistance to flow, etc.

Since 1922 the use of alcohol mixtures has been compulsory in France. This provided a fuel of high anti-knock value, and compression ratios were immediately increased from 5.6 or 5.8 to around 6.5. However, just about the time this transformation in engine design had been completed there arose a shortage of alcohol (which is needed in the manufacture of smokeless powder), and it became unavailable as a blending agent for motor fuel. The resulting problem was solved by an improvement in the quality of gasoline, by the use of aluminum cylinder heads, and by improving the finish of the combustion-chamber walls. The author said he was personally interested in a process of finishing combustion-chamber walls by chromium plating intended to permit an increase in the compression ratio.

In the remainder of his paper the author gave brief descriptions of the leading European light cars, with comments on their characteristics and their appeal to the purchasing public.

## ***Underwood Oxidation Tests and Service***

**H.** C. MOUGEY, of the G.M. Research Division, in a paper entitled "Underwood Oxidation Test and Its Correlation with Service," traced the development of tests for the determination of the oxidizing or sludging properties of lubricating oils since the time of the World War, when some work along this line was instigated by the Automotive Section of the War Industries Board, Council of National Defense. One test, developed by a group of research men connected with the Standard Oil Co. of Indiana, has come into wide use and is known as the Indiana oxidation test.

Cadmium bearings were introduced in large production at the beginning of 1935, and trouble from corrosion of these bearings soon became serious, especially: (1) In areas where sustained driving at high speeds was most common and crankcase oil temperatures therefore were high; (2) where engines were heavily loaded, as in certain truck and bus services; (3) in certain makes and models of cars, and (4) with particular brands of oil, including those containing acid oiliness addition agents, and also with certain highly refined oils which showed a tendency to develop acidity due to oxidation in use in the engines at high temperatures.

This latter observation was in accord with the finding of the Standard Oil Co. of Indiana, that white oils upon oxidation tend to develop acid rather than sludge. Further work on the problem by the research staffs

of the oil and automotive industries showed that oxidation of oil in engines depends to a large extent upon catalysts and inhibitors. Iron and copper, both of which are among the materials of which engines are manufactured, are powerful catalysts, and oxidation inhibitors are present in all crude oils, but they are removed to a greater or lesser extent by the refining processes. One deficiency of the Indiana oxidation test is that in it the oil is in contact only with the walls of the glass flask, no metal being present, hence the catalytic effect is absent. This deficiency was eliminated in a test developed by A. F. Underwood of General Motors Research Laboratories and described by him in a paper presented at the S.A.E. 1938 Summer Meeting. In the Underwood test (Fig. 1) the oil is discharged from a tube against a 2 by 10 in. copper baffle and a cadmium-silver bearing—both of which are freshly abraded to remove the burnished or cold-worked surface layers—for five hours at 325 deg. Fahr. Early experience with this test indicated that an oil which does not corrode the cadmium-silver bearing in 5 hours would not give trouble from corrosion in service, unless the driving conditions were unusually severe.

Mr. Mougey in his paper described and gave the results of both laboratory and road tests carried out to determine the effects of such variables as load, speed, ventilation and crankcase oil temperatures on the oxidation of crankcase oils. Tests were made with a

commercial, trade-marked, medium-price 20-W oil in a new six-cylinder engine, and observations with respect to sludge and varnish were made at the end of each run. These tests showed that under the particular conditions the crankcase oil temperature was the most important of the factors studied, the load, speed, crankcase ventilation and piston temperature having little effect. It is true that sludge troubles sometimes are experienced in engines of passenger cars operated in city traffic or under similar "mild" conditions, and laboratory experiments indicated that even though the "bulk temperature" might be kept low, throwing hot oil on hot surfaces, such as the under side of the piston head, would raise its temperature abnormally for a short time and thus cause oxidation.

Tests were made also with cars used by G.M. engineers on long drives. Six different oils were used, having different resistances to oxidation, and determinations were made of the acid number, Conradson carbon number, chloroform-soluble, and naphtha-insoluble. In the Underwood test the percentages of chloroform-soluble and naphtha-insoluble (sludge) are almost identical, and in making Underwood tests it is usual to determine the naphtha-insoluble only, although in an engine the percentage of chloroform-soluble may be much higher, on account of the presence in used crankcase oils of products of the thermal decomposition of the oil.

The tests on oils from the crankcases of cars in service were reported in the form illustrated by Fig. 2. The particular oil for which test results are shown in this figure oxidized quite rapidly and soon gave high values for the acid number, Conradson carbon, the chloroform-soluble and the naphtha-insoluble.

An S.A.E. research committee on crankcase oil stability last January made a report of tests on six crankcase oils. These oils also were subjected to the Underwood test, so that an opportunity was afforded for a comparison of Underwood data, oil analyses, dynamometer tests, and actual service records. From all of these data the author drew the following conclusions:

By means of the Underwood test we can

1. Test an oil to determine whether or not it will oxidize, and if it does oxidize, what products (acid, sludge, etc.), will be formed, and in what amounts.

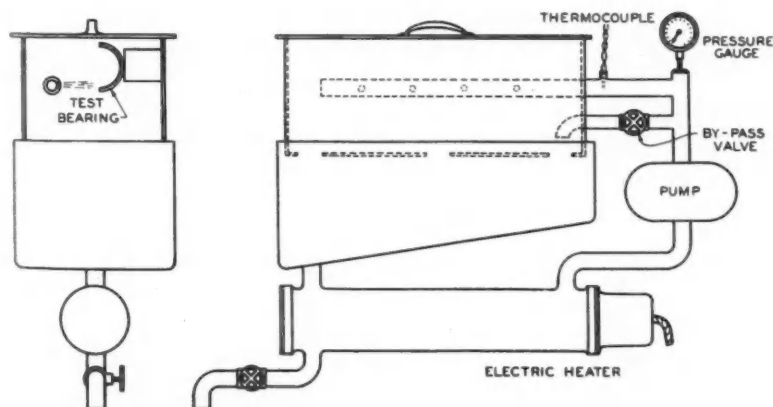


Fig. 1—Apparatus used in the Underwood oxidation test

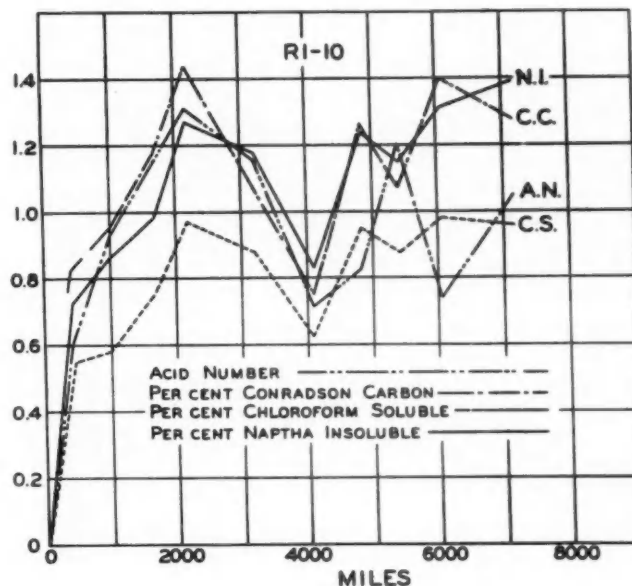


Fig. 2—Tests of oils from the crankcases of cars in service

2. Determine the amount of inhibitor, in an oil, by adding measured amounts of a catalyst, and find out how much catalyst is necessary to neutralize the inhibitor in the oil. This determination of the amount of inhibitor in the oil measures the total amount of inhibitor present, but it does not distinguish between inhibitor derived from the crude oil and inhibitor added to the oil.
3. Determine the oxidation characteristics of the oil without inhibitor, by adding enough catalyst to counteract the effect of the inhibitor in the oil and then oxidizing the oil. This test indicates the character and amount of oxidation products which may be expected when the oil is oxidized in the engine under conditions where the inhibitor is not effective, for example, on the cylinder walls or in the combustion chamber.

By making engine runs under controlled conditions, and by making tests on the road under service conditions, and determining what loads, speeds, temperatures, etc., are typical of different types of service, it is possible to learn under what conditions the following are important:

1. Oxidation in the crankcase resulting in increase in viscosity and forming acid or sludge or both, depending upon the properties of the oil and the amounts of inhibitor and catalyst that may be concerned. It is evident that high crankcase temperatures make these factors important.
2. Decomposition of sludge on hot surfaces—under the piston crown, for instance—and then dropping off in flakes or grains. This is the so-called "coffee-ground" sludge.
3. Decomposition of the oil in the combustion chamber forming "carbon" on the pistons and in the combustion chamber.
4. Contamination of the oil in the crankcase

as the result of some of the products of decomposition in the combustion chamber working down past the pistons and mixing with the crankcase oil.

5. Formation of "varnish" on the piston surfaces and other crankcase parts as the result of further oxidation or baking of partially oxidized oil or sludge.

By correlating Underwood tests on oils and the performance of these oils in engines of different designs under the different operating conditions, it is possible

to predict from the laboratory test data the oxidation characteristics of the oils under specific service conditions. From all these data it is apparent that high crankcase oil stability, as measured by the Underwood oxidation apparatus, is definitely related to good performance in engines with high crankcase oil temperature, or in those in which the under sides of the pistons are sufficiently hot so that the effect on the oil is the same as if the crankcase oil temperature were high.

## Light-Weight Transportation Units

**I**N THEIR paper on "Light-Weight Transportation Units," Frank Jardine, A. H. Woollen, and D. S. Mussey, all of the Aluminum Company of America,

devoted considerable space to the use of aluminum in motor buses. Most modern buses are of the chassis-less type, and designers figure that the passenger load is transmitted to the side frame of the bus body through cross members adjacent to the spring shackles, the side frame carrying the bending load from there on. Consequently, many buses are designed with non-continuous longitudinal and continuous cross members, and the results have been highly satisfactory.

In such constructions the passenger load is generally assumed to be carried by the side walls of the bus body. However, the load on the spring shackles must be transmitted to the side walls through cross members adjacent to the shackles, and as there are always longitudinal floor supports, either continuous or non-continuous, to take care of longitudinal forces such as those due to acceleration and deceleration, the question arises as to how much of the total load is carried by these longitudinals and how much by the side walls of the body.

A study of stress distribution in the members of an aluminum bus body was made in 1937 by the Aluminum Company of America in co-operation with the bus builder. There were wide differences between the calculated and the measured stresses. On the average the measured stresses were only one-fourth the calculated stresses. Under operating conditions on rough pavements the dynamic stresses were as much as three times the measured static stresses, while under unusually severe operating conditions they were five times as great. Because the calculated static stresses were four times as great

as the measured stresses, there was reasonable agreement between the maximum total (static plus dynamic) calculated and measured stresses. In making the tests, sand bags of an aggregate weight of 16,000 lb. (representing a full complement of passengers) were distributed to simulate the passenger load, over the floor of an aluminum body weighing 2952 lb. Tests made with strain gages showed a maximum stress of 1600 psi. in the center cross section of the body, 2800 psi. at the bottom of the channel sill of the central door, at the front of the door; 1700 psi. (compressive) in the rear wheel housing; 2900 psi. tensile and 3100 psi. compressive in the four cross members to which the spring shackles were attached.

Dynamic stresses, measured with a Baldwin-Southwark scratch strain gage, were as much as three times the static stresses measured, in normal operation at 20-40 m.p.h. To simulate extremely severe dynamic loads, the bus was run over equally spaced 4-in. timbers at different speeds. Under these conditions stresses as high as five times the static stresses were measured in both the underframe and the superstructure. Under dynamic loads there was a reversal of stress—sometimes practically complete—in both the underframe and the superstructure.

It is impossible to develop formulas for the design of bus bodies from these test results with strain gages, as the structure is too complicated, and the chief value of strain-gage measurements on bus bodies is as a check on bodies already built before they are placed in service.

The demand for faster schedules has placed a premium on grade ability and acceleration together with a top speed comparable to the cruising speeds of private automobiles. This demand could be met either by increasing the size of the powerplant or by reducing the weight of the vehicle, and the latter plan evidently is the most economical, especially as the increase in first cost is nominal. The advent of air conditioning has placed a further premium on light weight, and operators are trying to hold the weights of the air-conditioning units down and to reduce that of the vehicle itself so that air conditioning may not increase the total weight to any extent.

In addition to the advantage of its low specific gravity, aluminum offers the advantage that in extruded sections the material can be distributed in the most efficient manner. Fig. 1 herewith shows a number of such extruded aluminum sections as used in bus

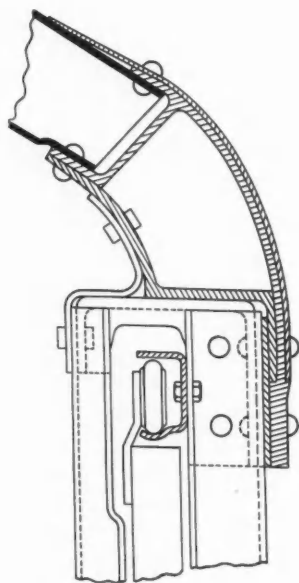


Fig. 1 — Detail of bus body showing the number of extruded aluminum sections



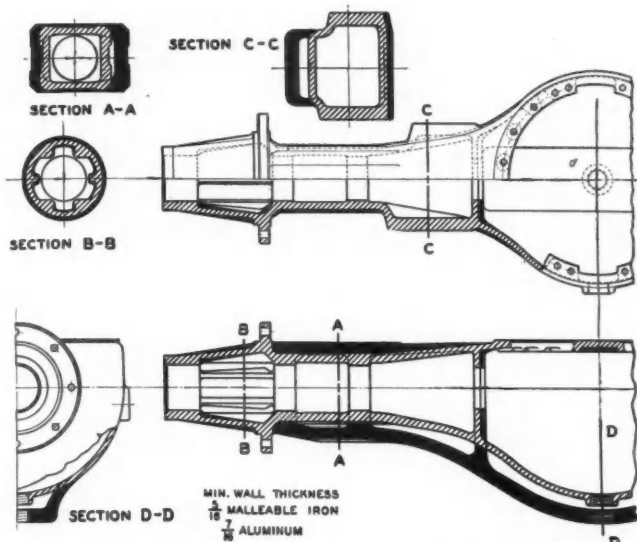


Fig. 2—Comparison of cross sections required for rear-axle housings of aluminum and malleable iron.

bodies. When extruded sections are used, the neutral axis can be readily shifted to prevent eccentric loading. A continuous top rail (a side plate section at a door opening) can be readily reinforced in the manner illustrated in Fig. 1.

The window sash for buses generally are purchased complete, including sash guides and curtain guides (if used). These parts are made for the most part of aluminum-alloy extruded shapes, which are joined together by gas or arc-welding or by mechanical means. The sash and exposed parts of the guides and trim may be buffed or given a satin finish. Natural aluminum color is the most popular and the least expensive. The "Alumilite" treatment also is excellent when an additional protective coating is desired to retain the natural color, but it cannot be used when the sash is gas- or arc-welded, unless provision is made to cover the weld, which otherwise shows up as an irregular stain after the alumiliting treatment. Electric butt welding for window sash is still in the development stage; it produces a very satisfactory joint which shows only a thin regular line when subjected to the alumiliting process.

At present single-raise or drop sash are in general use, in some cases with individual ventilators in the sash. As air-conditioning of buses grows it may mean the development of double sash to improve the insulation. These should be provided with an easily removable inner sash, so that the space between can be readily cleaned. Automatic dehydration of this space is provided

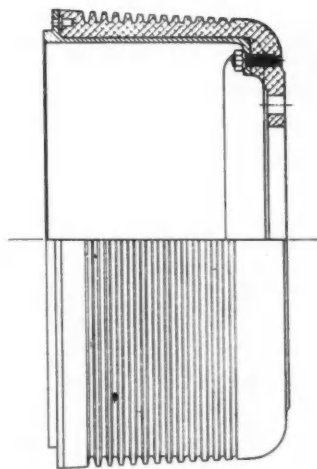


Fig. 3—Aluminum brake drum with gun-iron liner

in some railroad cars, but is expensive and not entirely satisfactory.

Aluminum doors are in general use on buses today. They are substantial, safe, and low in weight. In the transit type of bus these doors are generally operated by air or electricity, while in the inter-city type they are operated manually by the driver. Door structures are generally made of extruded sections for stiles and rails, and either double or single sheet panels. All joints are either gas- or arc-welded, while spot-welding is used where possible for securing the panels to the frame. When a part of the door is glazed, extruded sections similar to those of window sash are used.

Bus seats, which are not reversible, are divided into two general types, the reclining-back type used in inter-urban buses, and the non-reclining type used in city buses.

Buses and railcars generally have an interior finish that is a combination of aluminum sheet and decorative aluminum moldings. Pressed wood, Masonite, or similar material is used below the belt rail. The passengers usually sit close to the windows, and a metal window sill or metal finish below the window would be cold to the touch. In city buses little insulation is used, as a rule, and the wood panels serve as heat insulation as well as for finish. Headlining from the tops of the windows across the ceiling is usually made of aluminum or magnesium sheet and extruded molding for trim, or used as a combination of batten and decorative molding. City buses usually have stanchions at the doors.

A conventional 36-passenger bus of the type considered, if aluminum is used wherever practical, weighs 2952 lb. without seats and accessories, which represents a weight saving of approximately 50 per cent.

The authors also gave particulars of the possible weight saving in a truck chassis if aluminum were used in the engine and rear axle wherever practical. These data applied to a tank truck built for the Shell interests which carries 3850 gallons of gasoline and had traveled 473,000 miles up to Jan. 1, 1939. Following are the weights saved by the use of aluminum in various parts, and the percentage weight reductions: Intake manifold, 25.2 lb. (60 per cent); timing-gear cover, 13.4 lb. (48 per cent); engine block, 280 lb. (47 per cent); cylin-

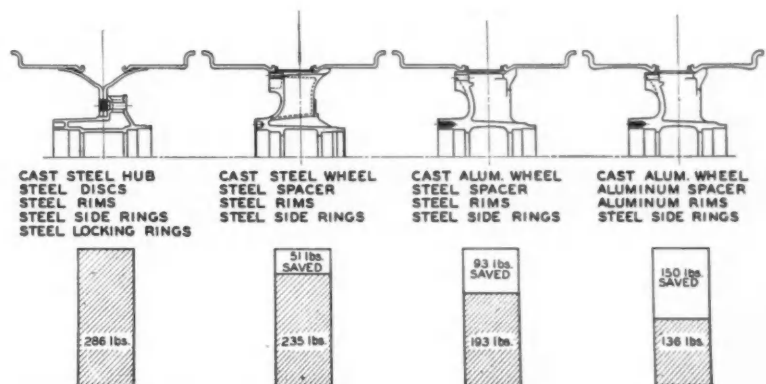


Fig. 4—Weight-saving possibilities by the use of aluminum in bus wheels

der head, 88.8 lb. (60 per cent); fan pulley, 6 lb. (50 per cent); pressure-pump body, 0.9 lb. (60 per cent); pressure-pump cover, 0.9 lb. (60 per cent); water-pump body, 6.0 lb. (60 per cent); accessory bracket, 17.5 lb. (54 per cent); front-support tube brackets, 6.7 and 6.5 lb. (50 and 49 per cent); rear-axle housing, 86 lb. (37 per cent); axle-housing cover, 15.0 lb. (58 per cent); axle-housing tube, 3.0 lb. (9.5 per cent); brake anchor bracket, 19.8 lb. (43 per cent); brake camshaft bracket, 3.3 lb. (45 per cent); brake drums, 57 lb. (30 per cent); brake dust shield, 3.0 lb. (61 per cent); hub for disk wheel, 58 lb. (47 per cent); wheel castings, 199 lb. (64.5 per cent); spring front bracket, 19 lb. (49 per cent); spring rear

bracket, 12 lb. (40 per cent). The total saving in chassis weight was 1727 lb., and this together with a saving of 2952 lb. in body weight resulted in an overall weight saving of 4679 lb. The aluminum truck cost 16.5 per cent more than the conventional one, and it is figured that if the trucks were operated as the one to which these data relate, the extra cost would be earned in 105 days of operation, because of the increased carrying capacity without increased running cost.

A few of the chassis parts made in aluminum are illustrated herewith, and in the case of the axle housing the sections in malleable iron and in aluminum are superposed.

## PRODUCTION LINES

### Light Weight

Some short time ago Fruehauf brought out its Aerovan trailer, incorporating unique design features which take advantage of a number of the new types of light weight, high tensile structural materials. Said to be stronger and more durable than conventional construction, the Aerovan appears to achieve the goal of economical transportation by reducing dead weight. For the framing of the structure, Fruehauf has adopted the high-tensile, low-alloy steels, one of which contains Nickel as the alloying ingredient. Paneling is executed in a special aluminum alloy sheet containing both nickel and chromium. Few riveted fastenings will be found, as the entire framing is welded.

### Fifty Years

The passing of fifty years of New Departure pioneering is marked by the appearance of the 13th edition of the N. D. Handbook prepared as a guide to engineers, designers, draftsmen. Current edition gives the load ratings of the gamut of bearing types and sizes, guide to bearing selection, information on bearing mountings, bearing weights. Interesting supplement gives tables of interchangeability—part numbers of equivalent bearings of other makes. Do you have a copy? If not ask us.

### Applied Science

While tons upon tons of metal chips are manufactured in the machine shops of industry each year, in the background there are alert technicians everlastingly searching for the key to what happens when metal is cut. End product of such research will be an improvement in metal cutting techniques, the solution to cost economy and quality. An impressive progress report on this subject is found in a booklet entitled "Physics of Metal Cutting," by Hans Ernst, who is on the staff of Cincinnati Milling Machine

organization. We were attracted particularly to a section dealing with the effect of cutting fluid because it shapes up as an answer to the research now in progress tending to demonstrate to the Department of Internal Revenue that cutting fluids are not and should not be classed as lubricating oils. If the major role of cutting fluid is that of a coolant, there is no justice in penalizing this widely used material by imposing the four cents a gallon tax that motorists pay for engine lubes. This is a *must* book for your desk. Not too late to get you some copies of it.

### New Models

Some interesting developments in zinc die castings are in the offing for the coming model year. For one thing there will be more die cast grilles, adding at least several new names to the current roster. About three pounds of zinc alloy per car will be contributed by a novel type of die cast horn which is expected to be widely adopted. Striking metallurgical achievement is the ability to press draw thin walled zinc die castings so as to produce very strong but relatively light hollow parts such as large handles, caps, spheres, etc. While this characteristic has not yet been applied in automotive design, it casts a slant on the remarkable ductility inherent in high grade zinc alloy.

### New Materials

Die castings of the special strong brass alloys developed by Doehler some years ago have been extensively used in certain types of applications. One of the most striking for automotive practice is the synchronizer ring which is being placed in production on many passenger car transmissions. Apart from its great strength and resistance to wear, this die-cast alloy shows remarkable cost economy in large production when compared with brass forgings or sand castings.—J. G.

# Method Study Promotes Economies

(Continued from page 648)

broached to a fine burnish finish on another battery of Foote-Burt machines. Each of the broaching operations is checked to precise tolerances for thickness and fit within the gage.

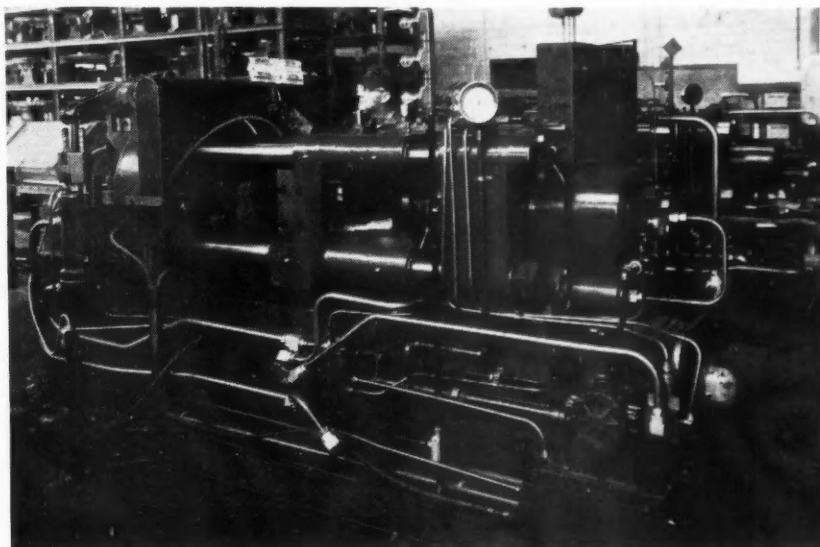
The set-up for copper-lead bearings involves much more of technical process resulting from constant improvement and development over a period of about four years. The process begins with small steel trays of a size sufficient to produce two flat blanks. The trays are loaded on a conveyor traveling through a special temperature-controlled oven, in which the first stage is a pouring station where a measured quantity of the alloy is poured into the tray. The station is fed copper-lead alloy at proper temperature from one of two small electric rocking furnaces.

Trays emerge from the machine ready for machine shop operations.

First step is to cut two blanks from each tray, on a battery of Verson presses. These are rough-broached on a continuous surface broaching machine to the working thickness of the strip, broached at the edges for flanging, then finish-broached for thickness on the continuous surface broach.

Blanks then are formed into half-shells, flanged, trimmed, and finally coined to size in a 400-ton press. The half shells proceed to a battery of Foote-Burt broaches which finish the parting line to precise tolerance, then are burred with a cupped wheel, and the outside diameter ground to size. Final operation is the diamond-boring of the half-shell diameter, followed by final inspection.

The oil filter department will be found rather interesting as it comprises the manufacture of the new



Close-up of latest type AC hydraulic die casting machine used by AC and sold to die commercial casters.

Meer-Kleen filter as well as the waste type filter which is still in use.

In a small corner of this department is located the operation of blending and preparing the special mineral wool ingredients with binder, tamping automatically onto the inner shell, baking in a small adjacent oven. The unit then is coated with an adhesive over which is applied the protective covering of coarse cloth casing.

From this point the procedure depends upon the destination of the unit. If intended for shipment to the replacement trade, the units travel directly to the packing station; if intended for assembly into attachment filters, the units are routed to a self-contained assembly line where they meet the shell and other parts.

This department specializes in many ingenious welding machine set-ups for spot welders, seam welders, etc., developed by National welding machines.

Plant 2 comprises manufacture of spark plugs, includes automatics, porcelain assembly, forming insulator blanks, clay preparation, shell and wire assembly, etc.

In the basement of the building is the department for producing the porcelain insulator. There are, naturally, the highly technical steps in the mixing and preparation of the clay for this purpose, together with the special equipment designed for this process.

In the cycle of events, the insulator body is produced in a long round continuous strip, cut to length, then pierced. The blanks are transported to the first floor, proceed to a large battery of special lathes where they are turned to form. Work then is placed in trays, sent on a conveyor to an inspection station, whence they are again loaded in trays and racked on a conveyor which transports them to the baking oven.

After baking, the insulators are delivered to a bat-

## Factory Routing Fuel Pump Cover

### OPERATION

### EQUIPMENT

Die cast	
Air test for leaks	
Trim, clean and machine	
Trim diaphragm flange, bowl seal and holes	No. 2½ E. W. Bliss punch press
Trim contour and clean inlet and outlet holes	No. 22 Bliss press
Chromate treatment No. 310 (run with disc grind)	
Disc grind diaphragm flange	Porter cable grinder
Wire brush diaphragm radius	Bench motor
Remove burrs outside and inside	Arbor press
Drill one bail hole, tap and burr inlet and outlet holes and two 6-32 valve plate holes	Kingsbury machine
Wash and burn out burrs	Ransohoff washer
Inspect and tag	



tery of cleverly designed automatic machines with rotary tables where each piece is sprayed with a ground coat, stencilled with trade mark and type designation, sprayed with glaze. They are now loaded into "saggers" (ceramic trays) racked and loaded on a conveyor for treatment in the kilns. Operations terminate with a final inspection in which the insulator is tested for dielectric properties and soundness.

Spark plug shells and terminals are machined in an excellent automatic department comprising a battery of 30 of the latest type National Acme-Gridley and New Britain-Gridley machines—comprising 1 in. New Britain-Gridleys, and 1 in., 1¼ in., and 1⅜ in. Acme-Gridleys.

On the second floor of the same building there is a machine shop for finishing the shell blanks—turning, drilling, threading—on batteries of special automatic machines developed by AC. Important feature is the use of magazine hopper feed to expedite handling of work pieces. Final operation is application of the blacking or black-oxidizing finish characteristic of the AC plug.

By far the most spectacular aspect of spark plug manufacture is the work on the assembly lines. Visualize two long self-contained merry-go-round conveyorized assembly lines, flanked by work-stations on each side, providing four distinct lines, partly shown in the illustration. Each of the lines incorporates approximately 25 different work stations.

Starting at one end, the shells are fed into a hopper magazine while the insulators travel on the belt conveyor. At the primary assembly stations where the plug elements are assembled, the upper gasket is fed down to the work station from a hopper while other small parts are taken from bins arranged for convenient grasping.

### Factory Routing Speedometer Main Frame

OPERATION	EQUIPMENT
Trim ends and top	No. 2½ Bliss press
Coin field plate pads and trim sides	No. 4 Verson press
Drill flash and countersink first and third worm holes	½ Avey drill press 2-spindle Krueger multi-head
Bore first worm hole and spotface each end	Special Krueger machine
Bore second worm hole, drill oil wick hole and mill jewel plate pads	Kingsbury machine
Drill two odometer holes, counterbore jewel plate and drill field plate holes	Kingsbury machine
Tap jewel and field plate holes and thread stem ⅝-18	Kingsbury machine
Line ream small and large diameter, second worm hole and burr small hole	Bench machine
Broach and burnish first worm hole and remove burrs from odometer shaft holes	American vertical hydraulic broach
Burr oil wick hole and first worm hole by hand	
Remove burrs with flexible tool	
Wash and blow off	Ransohoff washer

At the far end of the line, where the finished plugs appear, each one is automatically counted by an electric eye. The plugs then are gapped, dropped onto another conveyor for transport to the inspection station for the final dielectric test.

Plugs now move into the final setting—the packing room. What is done here depends entirely upon the destination of the plugs. They receive a visual inspection and are routed to one of two lines. If intended for original equipment, the plugs are packed directly into large cartons with pigeon-hole compartments; if intended for jobbers and the replacement trade, it's a different story. In the latter case, the plugs enter an automatic packing machine which they traverse on a special conveyor. The machine makes up the individual carton at one station, pushes the plug and washer into the carton at the next station, delivers the packed plugs to an assembly station where the operators pack ten of the small cartons into the familiar AC container.

*Plant 4*—comprises silencer assembly, silencer punch press department, pump assembly, diaphragm cloth production, miscellaneous machining, tube and shell forming, pump heat treat, pump punch press.

In air cleaner manufacture, the punch press department is located directly in communication with the



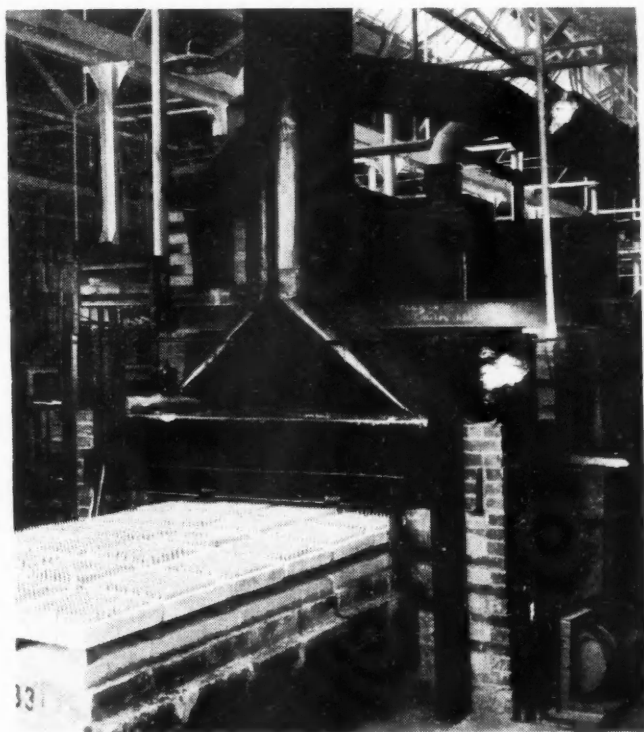
*Section of the speedometer assembly line showing layout of successive assembly stations. Note the feeder conveyor on the bench carrying the various component parts; also the layout of work stations with feeder hoppers as in the station at the extreme right.*

assembly line. Punch presses are of several makes and of various types, principally Bliss and Verson. In this department will be found a battery of Wright & Henry dieing machines for producing various silencer elements. Here, too, are a variety of National welding machines for the many sub-assembly and assembly operations.

Interesting feature is the battery of special machines for producing copper-mesh elements. In these machines, copper wire is fed on spools and in successive steps it is flattened, wound into bodies of required size.

While it is difficult for us to convey an impression of the complexity of operations and techniques involved in silencer manufacture, visualize, if you will, that no less than 13 different types of units are produced here. The assembly lines—of which there are two—are arranged on each side of the main overhead monorail which carries the complete variety of component parts.

Interesting spot is the conveyor line at the end of the assembly stations which transports the finished unit through a spray booth station where the silencers are automatically sprayed while rotating on the conveyor fixtures.



*View of a kiln in the ceramics department of the spark plug division. This shows spark plug insulators ready for firing.*

The fuel pump department is a major establishment in its own right. One feature is a self-contained department for the production of the fuel pump diaphragm. Here they take cloth as it is received in bolts, pass it through calender rolls where the cloth is coated with a special compound. Then it is conducted through a series of drying tunnels. During the operation, inspectors test the product by cutting random samples which are subjected to rigid laboratory tests. The finished material then is blanked to required size and made ready for the assembly department.

The fuel pump department has its own machine shop for the production of parts required in the assembly. Among the items of equipment is a battery of Cin-



*Striking example of quality control at AC may be visualized from this view showing microscopic examination of the speedometer jewel.*

cinnati centerless grinders with Danly Feedmatic magazine feed for finishing shafts.

Final assembly lines are characterized by work stations resulting from method study, typical examples being such details as bending the assembly line conveyor around certain work stations where special drilling or assembly fixtures are necessary. In all, there are four assembly lines for handling the variety of fuel pumps produced here.

After assembly, each pump is tested individually on one of the special test machines for pumping characteristics and priming. From this station the pumps are loaded onto a table conveyor moving down the visual inspection line and out to the packing department.

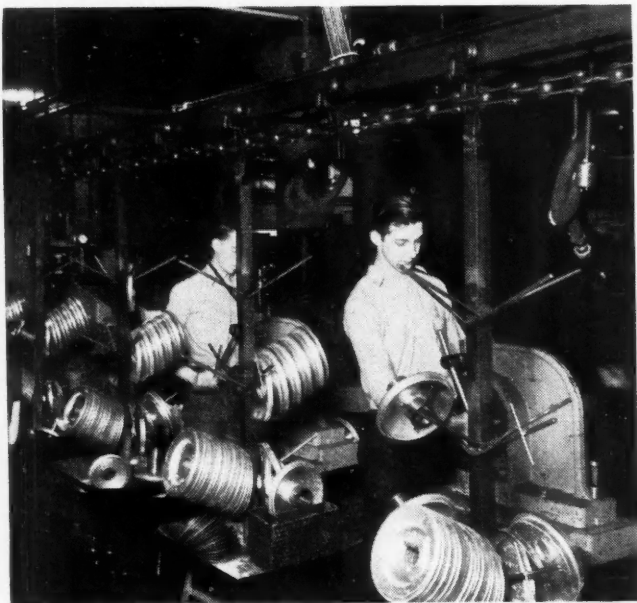
*Plant 5*—deals exclusively with die casting, die casting machines, machining of die castings.

As mentioned earlier, all of the die casting machines have been designed and built by AC. The earlier type of air-operated machine is rapidly giving way to the new hydraulically operated equipment.

Largest castings handled on the new hydraulic machines at the present time are the front side radiator grilles.

The machine shop set-up is worthy of special attention. To give a better picture of this, we have reproduced the complete routing of a speedometer frame and a pump body. This, together with some of the illustrations, gives the picture better than we could phrase it in words.

One of the high spots on the speedometer frame line is the multiple drilling machine set-up in which the drills are rotated at 12,000 r.p.m.



*Portion of the busy air cleaner assembly line which is completely mechanized to facilitate production. Attention is directed to the development of work holding attachments designed to simplify the handling of parts by the operators.*

*Plant 6*—this department is concerned primarily with the production of screw machine parts, cutting of small gears, miscellaneous secondary operations.

It boasts a large battery of New Britain-Gridley and National Acme-Gridley automatics, including new six-spindle automatics. Here, too, will be found all sizes of the new Brown & Sharpe and Davenport automatics.

As an example of one of the production jobs handled here, we have reproduced the routing of a special governor shaft which encompasses some very fine metal cutting operation. Unique feature is the cutting of a fine pitch, small diameter gear on this shaft, after heat treatment, when the surface hardness is of the order of Rockwell 30, C-scale. This operation is performed on a Fellows high speed gear shaper.

*Plant 7*—this is undoubtedly one of the most impressive of the departments in the AC group, featuring the amazing self-contained assembly lines for speedometers, thermo gages, oil gages, gasoline gages, panel assemblies, tank units. Serving these lines are—a comprehensive press shop, instrument printing establishment, plating and buffing department.

For an appreciation of these assembly lines, we urge a personal visit as no word picture could possibly convey even a reasonable impression of the range of activity. Some of the illustrations will aid in a visualization of certain aspects of the set-up and we shall have to be content with just a brief word description.

Let us note, at the start, that these assembly lines represent the sum total of years of specialization, aided by a generous application of method study in every step of the assembly process. Each work station is provided with special assembly fixtures and tools, served by conveniently located bins or hoppers for holding component parts.

Speedometer assembly takes place on a single assembly line, composed of a number of separate sec-

tions, interconnected by conveyors. For example, apart from other activity on the line, there are three separate merry-go-round conveyor sections. Although speedometer assembly is concerned with the integration of minute and delicate components, the job is done rapidly and with precision by the deft hands of the operators.

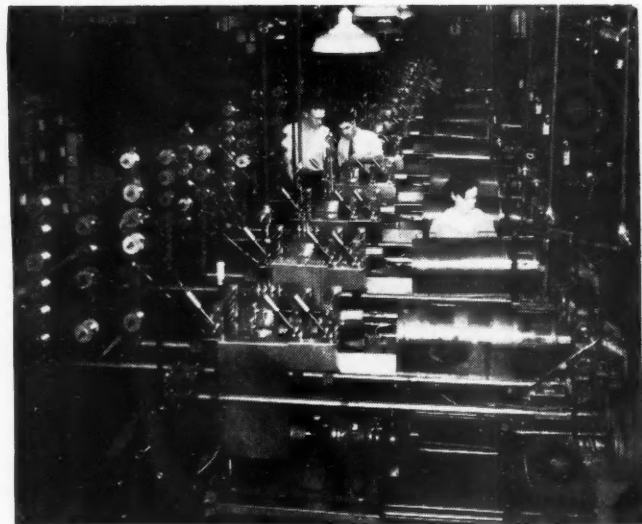
There are similar lines for the assembly of other panel instruments such as the ammeter, thermo gage, gasoline gage, etc.

Each assembly line is distinguished by painstaking inspection and calibration according to established standards of accuracy. Specialized equipment for this purpose will be found at every turn. To show how thoroughly this has been worked out, consider the set-up for calibrating thermo gages. Because the unit is so small it is necessary to make adjustments from the back, where the mechanism is readily accessible. For this reason, the instrument is mounted on the fixture with the back facing the operator; then to permit a view of the dial, the fixture is provided with mirrored disc background reflecting the dial and its marking.

A veritable maze of overhead monorail conveyors threads its way across the rear end of each of the assembly lines, receiving the entire variety of instruments as they pass inspection. The conveyor traverses the instrument panel assembly line where the instruments are unloaded and fitted into the proper units.

This plant boasts one of the most up-to-date printing establishments in the industry, printing dials for all of the instruments produced here. They print on any medium—paper, metal, glass. There also is a continuous lacquering machine for finishing instrument panels, with automatic spray stations and a continuous drying oven cycle.

Worthy of note is the glass department, where glass panels are prepared to size and chemically cleaned. Here the glass plates are carefully treated to assure perfect cleanness. They are first dipped in a chemical bath to remove oil or film, then a spray wash, several hot water rinses, and finally, a distilled water rinse.



*Air cleaner mesh woven from special copper wire is produced on this battery special machine which may be of particular interest because of difference from conventional equipment found in automotive plants.*

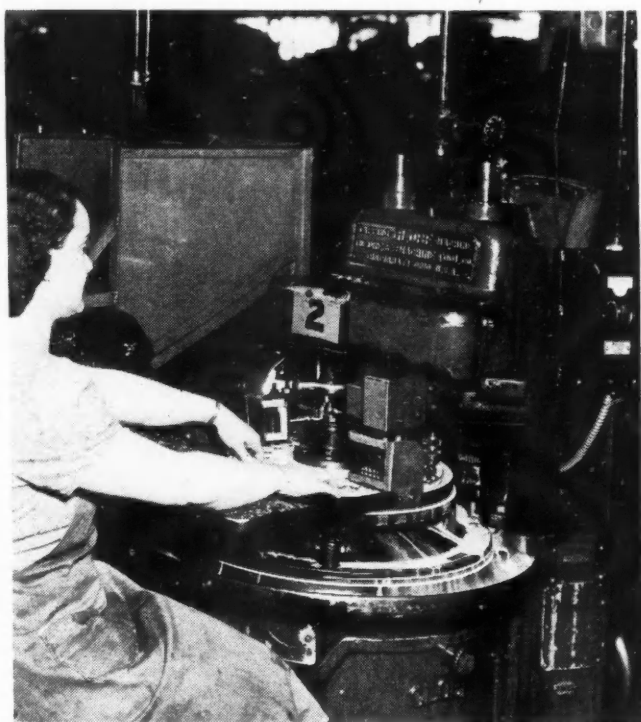


Press shop facilities for this department are quite outstanding. Feature is the use of progressive dies in which the alignment of blanks is spotted precisely and checked at each individual station by an ever-watchful electric eye. If even a single blank of a ten-station die is out of place, the machine is automatically stopped. Large Bliss presses are used for the panel and speedometer case stampings.

Rounding out these facilities is a comprehensive plating and buffing department with modern automatic equipment for plating zinc, nickel and chromium. High spot is a Divine continuous buffing machine with a multiplicity of automatic buffing heads, of the type familiar in leading plants of the industry.

### Research and Service

AC has one of the largest engineering staffs in the industry. A large research laboratory is maintained; a dynamometer department is in constant service night



*Latest Globe production tapping machine for tapping back plates for oil and thermo gages.*

and day, as is its research testing laboratory; field tests are made by a staff of engineers and inspectors in the field, and the facilities of the General Motors research and the General Motors proving grounds are utilized. Metallurgical and chemical operations are carried on constantly by specialists in this field.

The AC Service Department, which is operated on a broad and active scale, works closely with the Engi-



*Mechanical marvel is this automatic packaging machine which packs spark plugs in the familiar individual cartons for the jobbing trade. Cartons of ten plugs are assembled by the operators at the extreme right.*

neering Department. Service facilities in every section of the world and in nearly every hamlet in North America are available on AC products; service and engineering contacts are maintained between AC and every manufacturer using AC products. A consulting engineering service is also provided manufacturers. This is operated through the AC Equipment Sales Department.

Replacement sales of AC products, such as spark plugs, oil filters, fuel pumps, oil filter elements, Reflex signals, air cleaner elements, spark plug cleaners, etc., are handled by the AC Jobbing Sales Division. Several hundred wholesale distributors throughout the United States stock and sell these replacement parts, which are sold to the public through some 200,000 retail outlets—garages, car dealers, truck and bus outlets, super service stations, farm implement dealers, accessory stores, etc. This division maintains seven Regional Sales offices, strategically located in every section of the country. Working out of each one of these Regional Sales offices are a large force of AC salesmen who call on the trade—jobbers, dealers, etc.

### Factory Routing Governor Shaft

OPERATION	EQUIPMENT
Completely machine	1 in. R6 Acme National
Wash in cleaner	Gridley
Inspect	
Heat treat	
Inspect	
Rough grind	Cincinnati centerless grinder
Rough grind	Cincinnati centerless grinder
Face and burnish flange and undercut shoulders	Sundstrand lathe
Finish grind	Cincinnati centerless grinder
Serrate	No. 715 Fellows gear shaper
Wash in cleaner	

# Men and Machines . . .

**Howard W. Dunbar points out**

**A**NYONE concerned with the machine tool industry, professionally or otherwise, will find a great deal of interesting information in "Machine Tools and You," the latest publication of the National Machine Tool Builders' Association. The booklet is a reprint of an address presented before the Army Industrial College at Washington, D. C., by Howard W. Dunbar, past president of the Association and vice-president and general manager of the Grinding Machinery Division of The Norton Co.

Terming machine tools the "master tools of industry," and pointing out that without them it would be impossible to produce, commercially, most everyday necessities and luxuries, Mr. Dunbar discusses his subject under these sub-headings: Mass Production, What Is A Machine Tool?, The Five Basic Arts (Milling, Planing, Turning, Boring, and Grinding), Scope of the Industry, Concentration of Plants, Management, Personnel, Working Conditions and Problems, Life of Machine Tools, Development of New Designs, Skill Built Into Machines, Specialization, Methods of Manufacture, Sales Volume and Prices, Selling Methods, Sales Problems, Markets, and Machine Tools for Defense.

Many of the points made by Mr. Dunbar under the afore-mentioned sub-headings are naturally well-known to readers of *Men and Machines*. There are, however, several statements which seem to deserve re-emphasis and which space will permit us to include.

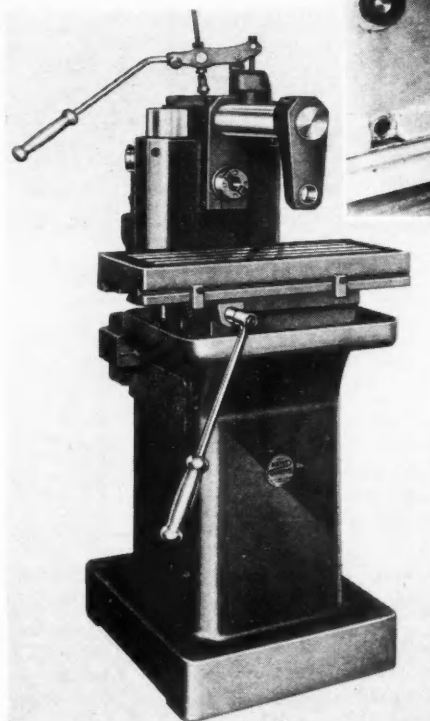
For instance, it is pointed out that there is no monopoly in the machine tool industry. Today the tendency is for each company to specialize on one type of machine, developing it to a high degree. Before the industry reached its present state any machine tool builder would produce any type of machine tool for which he could find a market, but a company which tried to do that today would face in every division of its work the competition of a group of specialists which would make successful operation practically impossible. "Competition," says Mr. Dunbar, "is very keen, not only between builders of the same type of machine, but also because, on many parts, various types of machines can do the work, and it is a close question as to what method of manufacture would be best."

"In an industry where a typical order

calls for just one machine tool, it is obvious that machines cannot be put through in very large lots. It is one of the paradoxes of American industry that the manufacturer of equipment for mass production cannot use mass production methods in his own plant. Wherever possible, however, the industry manufactures small elements like gears, pins, shafts, and levers

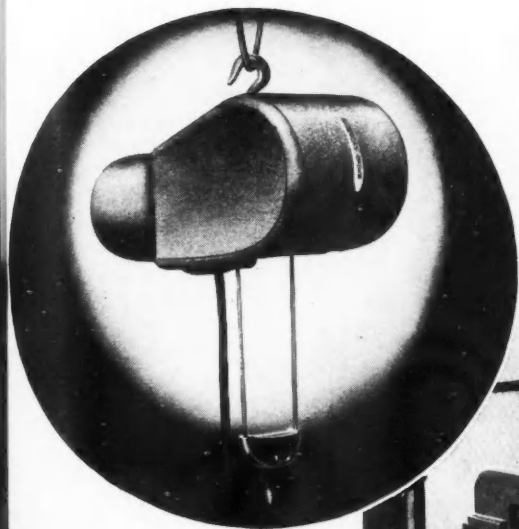


(Above) Precision adjustment of bearing caps and plates in metal lathe and shaper assembly is obtained by the Atlas Press Co. through the use of laminated shims which peel for adjustment.



(Left) The Kent-Owens No. 1-M hand mill designed for a wide range of light and medium milling operations.

## the tendency of Machine Tool Builders to specialize on one type of machine



(Circle) Electric hoist recently placed on the market by the Conco Engineering Works, Division of H. D. Conkey & Co., Mendota, Ill.

(Right) The Blanchard Machine Co.'s new adjustable gap demagnetizer.



in quantity and puts them into stock. These small parts are then drawn out for manufacture into sub-assemblies, which again are put into stock. These, in turn, are drawn out for the main assembly as fast as the base or bed of the machine comes to the assembly floor. To obtain further economies certain parts are made interchangeable over a range of sizes. In some divisions of the industry special machines are developed for unusual needs by applying standard units or heads to a welded steel base. The use of welded steel eliminates the cost of the wooden pattern required when castings are used, and makes possible great flexibility in the arrangement of the machine.

"Under this system of manufacture the need of developing special machines or of departures from normal commercial standards, or of meeting unusual specifications, seriously interferes with normal manu-

facturing processes. It means confusion in the engineering department, and the danger of misunderstanding and error in the shop and on the assembly floor. The manufacture of a special machine involves complicated production control and makes it much more difficult for men in the industry to benefit from a wage incentive, because the job is unusual and slows up production."

Under the sub-heading, Machine Tools for Defense, Mr. Dunbar places further emphasis on a statement made by August H. Tuechter, president, Cincinnati Bickford Tool Co., which was quoted in *Men and Machines*, March 11. "From the standpoint of business and profit," says Mr. Dunbar, "the progress and prosperity of the industry are part and parcel of the normal peacetime progress and prosperity of the whole country. The industry is dedicated to the arts of peace; its major objective is the production of equipment which makes for better, happier living for all."

If you wish, we shall be very glad to forward your request for a free copy of this excellent booklet to the National Machine Tool Builders' Association.

A hand miller for a wide range of light and medium milling operations is one of the latest products of the industry. A new twin post construction has been used to carry the head, and the spindle is located midway between these posts. The entire head is counterbalanced so that its weight and the weight of tooling carried offer practically no resistance in feeding the head. This counterbalance is fully adjustable to compensate for any changes in weight due to tooling, overarm or pendant. It is accomplished by a long, adjustable coil spring with self-compensating lever construction. The cylindrical post construction is said to provide excellent bearing for the head and to eliminate cocking action inherent with conventional gib construction, also any tendency to chatter.

A table, 9 in. by 25 in., is fixed at a convenient working height and slides on accurately scraped ways in the machine bed. The table has a total movement of 12 in. and is fed  $4\frac{3}{4}$  in. for 180 deg. of lever movement.

(Turn to page 687, please)



## That Truth May Prevail.....



**"Mr. Knudsen, many women have asked me DOESN'T ADVERTISING MAKE CARS COST MORE?"**

**On the contrary, Mrs. Richardson. Advertising is one of the big reasons why cars cost considerably less.**

**"I wish you'd explain that, Mr. Knudsen. How can an expense like advertising possibly be an economy?"**

**"Well, take this old car here on the platform . . . a good illustration of what I mean. It's an Oldsmobile, in case you don't recognize it . . . a 1910 Oldsmobile. And it sold for \$5,000. The vastly superior Oldsmobile we're building today sells for \$829 at Lansing, ready for the road. Quite a difference, eh?"**

**"But surely that big drop in price couldn't be credited just to advertising, Mr. Knudsen? Wasn't it more the result of mass production?"**

**"Mass production and advertising, Mrs. Richardson . . . and which to put first is almost like the chicken and the egg. For, while mass production does bring costs down, it is advertising that makes it possible to apply mass production effectively. Let me explain."**

**"Year by year, we automobile manufacturers strive to increase the value we put in our cars. Each year they become more comfortable, safer, better-looking, more powerful. Now if we relied on word-of-mouth to tell people about these improvements, it would take a long while for the story to reach even a fraction of the people who might be good prospects."**

**"But through advertising we can tell our whole story to the whole country in a very short time . . . we can find the largest number of buyers in any given season. And thus we can count on a larger annual output."**

**"Advertising helps to reduce our prices even before we get the benefit of the manufacturing savings that come from mass production. For example, if we could count on selling only one hundred thousand cars, all our costs of new dies, new machinery and factory overhead would have to be divided among that many cars. But if, with the aid of advertising, we can safely count on selling two hundred thousand cars, we can cut the charges against each car almost in half."**

**"And is that true of other industries, Mr. Knudsen?"**

**"I'm sure it is. Advertising is, in a sense, a means of insuring a certain level of sales. When a manufacturer can safely plan on selling a certain volume of goods, he can safely shave his prices, safely invest in new equipment for his factory, and even count on employing more people."**

**To give you the truth about advertising and its influence on the welfare and prosperity of the American people, we have gone to those who are in the best position to know the facts. Interviews with these business leaders, about advertising's social and economic benefits to you, will appear in Collier's, Woman's Home Companion, The American Magazine and The Country Home—published by The Crowell Publishing Company.**

Mrs. Anna Steese Richardson, Director of Consumer Division, The Crowell Publishing Co., gets the facts about advertising from Mr. W. S. Knudsen, President of General Motors.

**"There is not, and never has been, any real conflict between business and people — but there has been a lot of misunderstanding. The time has come for advertising to come to its own defense—with advertising"—so stated Thomas H. Beck, president of the Crowell Publishing Co. in launching a movement described as the first real action of business to meet the nation-wide attacks on advertising. Supported by such firms as General Motors, Westinghouse Electric, General Foods, International Harvester and American Radiator, full page advertisements will appear throughout the year in the four Crowell publications. Typical of the advertisements is the one reproduced here, illustrating W. S. Knudsen, General Motors president, being interviewed by Mrs. Anna Steese Richardson, director of the consumer division of the Crowell Publishing Co. This advertisement, one of the first in the "Truth About Advertising" campaign, appeared in the May 27 issue of Collier's.**

## NEWS OF THE INDUSTRY

### War Department Announces 2000 Hp. Aircraft Engine

*A Double-Row, Air-Cooled, Radial Type with 18  
Cylinders Built by Wright Aeronautical Corp.*

Development of the world's largest and most powerful air-cooled aircraft engine by the Wright Aeronautical Corp., Paterson, N. J., with the assistance of U. S. Army Air Corp' engineers, has been announced by Louis Johnson, Assistant Secretary of War.

The new engine is known as the Wright Duplex-Cyclone and is a double-row, air-cooled, radial type with 18 cylinders arranged in two rows of nine cylinders each and rated at 2000 hp.

The new Duplex-Cyclone has four more cylinders than the 1500 hp. Double-Row-Cyclone 14 from which it was developed, and as its name implies is virtually two nine-cylinder engines built on one crankcase and using a common crankshaft.

Paving the way for larger and faster commercial and military planes, the new power plant was developed secretly with the aid of Air Corps' experts in the engineering department of the Wright Aeronautical Corp. during the last two years.

Two of these engines powered the new long range Consolidated Flying Boat which made its first flight several weeks ago with 52 passengers and a crew of five on the Pacific Coast.

The U. S. Army Air Corps is displaying the Duplex-Cyclone publicly in its exhibit in the Aviation Building at the New York World's Fair.

### Foreign Firms Confer With American Chem. Paint Co.

Technical sessions and trips to Detroit and other automotive centers are included in the conference which began May 28 between executives of the American Chemical Paint Co., Ambler, Pa., and executives of affiliated firms in 14 foreign countries. The program will continue until June 10.

The following foreign firms were represented:

Imperial Chemical Industries, London; General Agencies, Brussels; Compagnie Française de Produits Industriels, Asnières, France; Heinrich

Wagner and Co., Zurich, Switzerland; Luigi Sciorelli, Torino, Italy; Gerhard Collardin, Cologne, Germany; Bulow and Co., Copenhagen, Denmark; Arstal and Co., Oslo, Norway; Rudolph Berggren, Stockholm, Sweden; M. Wieraszal, Warsaw, Poland; Industrial Chemical Products, S. A. Ltd., Johannesburg, South Africa; Industrias Químicas Brasileiras "Duperial," S.A., Rio de Janeiro, Brazil; Beick, Felix y Cía., Mexico City; Sample and Co., Havana, Cuba.

### Business Doubles For General Plastics, Inc.

Business of General Plastics, Inc., of North Tonawanda, N. Y., in the first

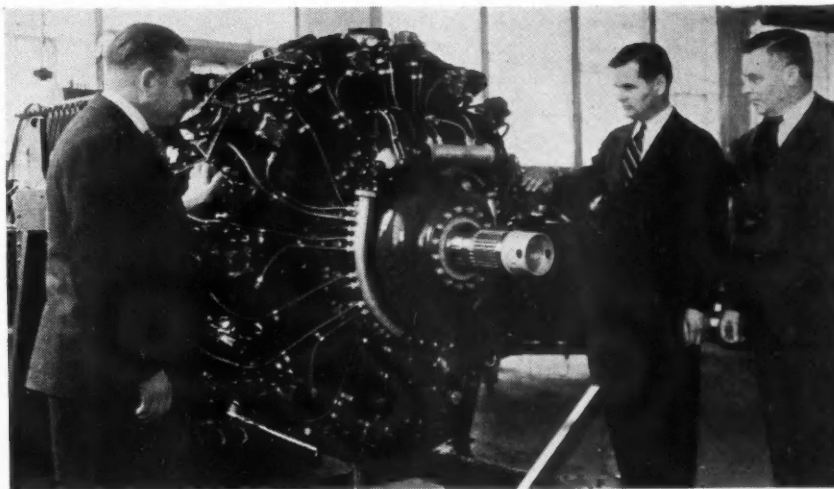
quarter this year was nearly double a year ago and the trend continued through April, due largely to increased orders from the automobile industry, according to John F. Snyder, treasurer.

"Very satisfactory" orders have been coming in, particularly from the motor car industry, Mr. Snyder said. Most of the automobile demand has been mouldings for ignition systems.

Employment in the plant has been increased sharply in the last year to approximately 375 from around 250. Mr. Snyder said that production and employment would be increased further when the phenol plant, now nearing completion, is opened during the summer.

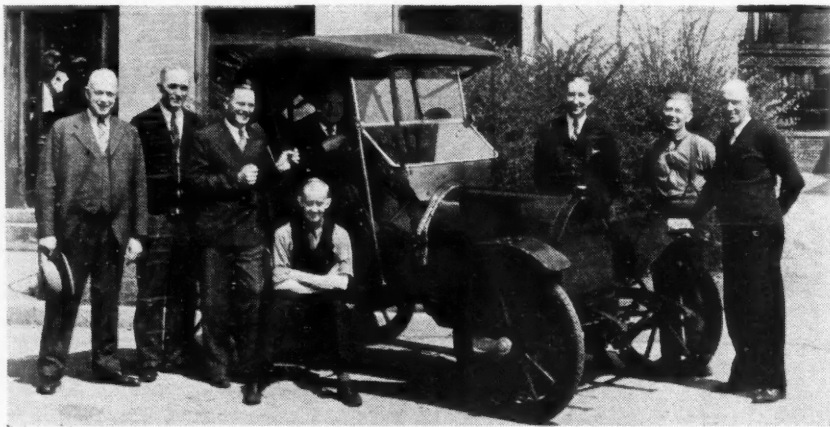
### New Sterling Plant

Sterling Products Co. has announced the completion of its new plant in Los Angeles. The new plant covers over 10,000 sq. ft. Purpose of establishing the plant was stated by the company to be for better service to West Coast customers. Shipments to the rest of the country and for export will continue to be handled from Detroit.



### The 2000-Hp. Wright Duplex-Cyclone

(Left to right) George Chapline, vice-president, P. B. Taylor, chief engineer, and M. B. Gordon, vice-president and general manager of the Wright Aeronautical Corp. shown with the new 18-cylinder, 2000 hp. Wright Duplex-Cyclone engine recently announced by the War Department. Two of these engines powered the new long range Consolidated Flying Boat which made its first flight recently on the Pacific Coast with 52 passengers and a crew of five. (See photograph on page 674)



### "Old Timers" at Graham-Paige

Eight men who worked on this 1909 Paige and who also helped build the 1939 model Graham, shown with the old car which was paraded as part of a company birthday party held recently by dealers in the Graham plant. From left to right are Charles F. Huntoon, chief of Graham's private police force; Fred B. Rosenau, general foreman of the final test department; Homer Borek, experimental driver; Jesse H. Monshor, in charge of surplus stores; George H. Petersen (at the wheel), factory manager; J. W. Mitchell, chief inspector; Bruce Bailey, car assembly, and George Serrine, in charge of car shipments.

## "We Have Not Yet Reached The Point of Saturation," Says Sloan

*Expresses View Before TNEC That "As National Income May Go Up, the Industry Also Should Go Up at Increased Rate"*

Alfred P. Sloan, chairman of the General Motors Corp., told the temporary National Economic Committee at Washington on May 18 that he does not believe the automobile industry has reached a point of stabilization or saturation. Countering an opinion to the contrary held by some economists, Mr. Sloan said that as the national income may go up, the industry also should go up at an increasing rate.

"There are more motor cars today than ever and we have not yet reached the point of saturation, particularly as long as we are able to capitalize on technological improvements," said Mr. Sloan.

In the course of questioning by committee members, Mr. Sloan, reflecting a critical attitude toward the administration taxation policy, declared:

"We've got to have more profit in industry as a whole. The reason the automobile industry has been able to do the things it has done is that it has had a fair margin of profit, but we must encourage industry to make money and encourage people to put their capital into industry."

At press conferences between and after his appearances before the committee, Mr. Sloan emphasized his views on the present purpose of the TNEC as outlined by President Roosevelt, who said a major problem of the committee is to ascertain "why a large part of our vast reservoir of money and savings has remained idle in stagnant pools."

Mr. Sloan told the Press that America's "idle men, money and machines" are being matched by "idle opportunities." Agreeing substantially with suggestions made the day previous by Owen D. Young, chairman of the Gen-

eral Electric Co., Mr. Sloan urged encouragement to business through tax and bankruptcy reforms.

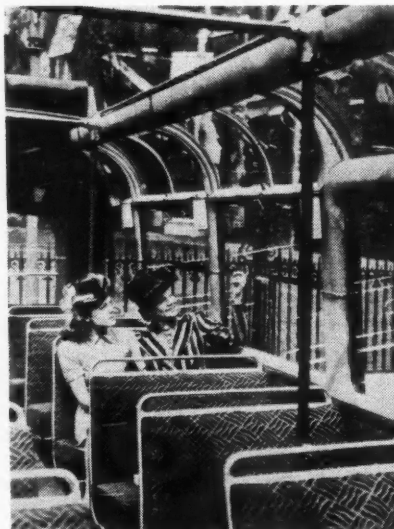
"We must do something about it, not merely talk about it," Mr. Sloan said. "Something was said here a few days ago about idle men, money and machines. To that I would add idle opportunities, opportunities which are all around us for stimulation and improvement of business."

Mr. Sloan declared that the administration could encourage business by reiterating its faith in the profit motive by lending its strength to tax revision efforts and by working toward a balanced budget through reduced expenditures rather than increased taxation.

He told the committee how General Motors, like many other key industries of the country, has lived and grown largely on its own revenues without recourse to the outside capital markets.

General Motors, he stated, in the 1922-1939 period has made sales in excess of seventeen billion dollars with profits of about two billion three hundred thousand dollars. It was explained that some four hundred ninety million of this profit had been retained and five hundred twenty million more had been accumulated for depreciation charges, all being plowed back into operations of the company, and divided generally as follows: Seven hundred seventy million for expanding plant and equipment, one hundred seventy-six million for subsidiary operations and three hundred thirty-six million for special tools. Mr. Sloan said that in the last nine years 93 per cent of profits was distributed among stockholders and over the entire 18-year period a little less than 80 per cent was distributed.

In telling the committee that the lack of confidence in profit making in private



### New Buses for London

At the left is an interior view of one of the new buses recently put into service in London, England. They are equipped with safety-glass roof, radios, gears that will not mesh if brakes are defective, full view vision for the driver and a special fog lamp. The latter can be seen in the front view at the right.



enterprise underlies the failure of business to make greater use of idle credit, Mr. Sloan urged reconstruction of the present tax structure. He proposed elimination of the capital gains tax to "give more flexibility to capital to flow into new enterprises" and complete elimination of the undistributed profits tax.

Mr. Sloan said he did not believe there would be a war. He made this observation after stating he thought activity in the automobile industry would continue this year at about the present rate unless "some strong outside influence like a war in Europe" should be felt.

## General Motors April Car Sales

April sales of General Motors cars and trucks from all sources of manufacture totaled 158,969 compared with 109,659 in April a year ago, according to a report by the corporation. Sales in March were 182,652. Sales for the first four months of 1939 totaled 648,253 compared with 407,930 for the same four months of 1938, an increase of nearly 60 per cent.

Sales to dealers in the United States totaled 126,275 in April compared with 78,525 in April a year ago. Sales in March were 142,743. Sales for the first four months of 1939 totaled 501,872 compared with 275,376 for the same four months of 1938.

Sales to consumers in the United States totaled 132,612 in April compared with 103,534 in April a year ago. Sales in March were 142,062. Sales for the first four months of 1939 totaled 446,790 compared with 329,456 for the same four months of 1938.

## UAW Delegates to Meet In Buffalo on June 3

The second meeting of general delegates authorized by the United Auto Workers Union to set up a National Council to negotiate with General Motors plants will be held in Buffalo, N. Y., June 3.

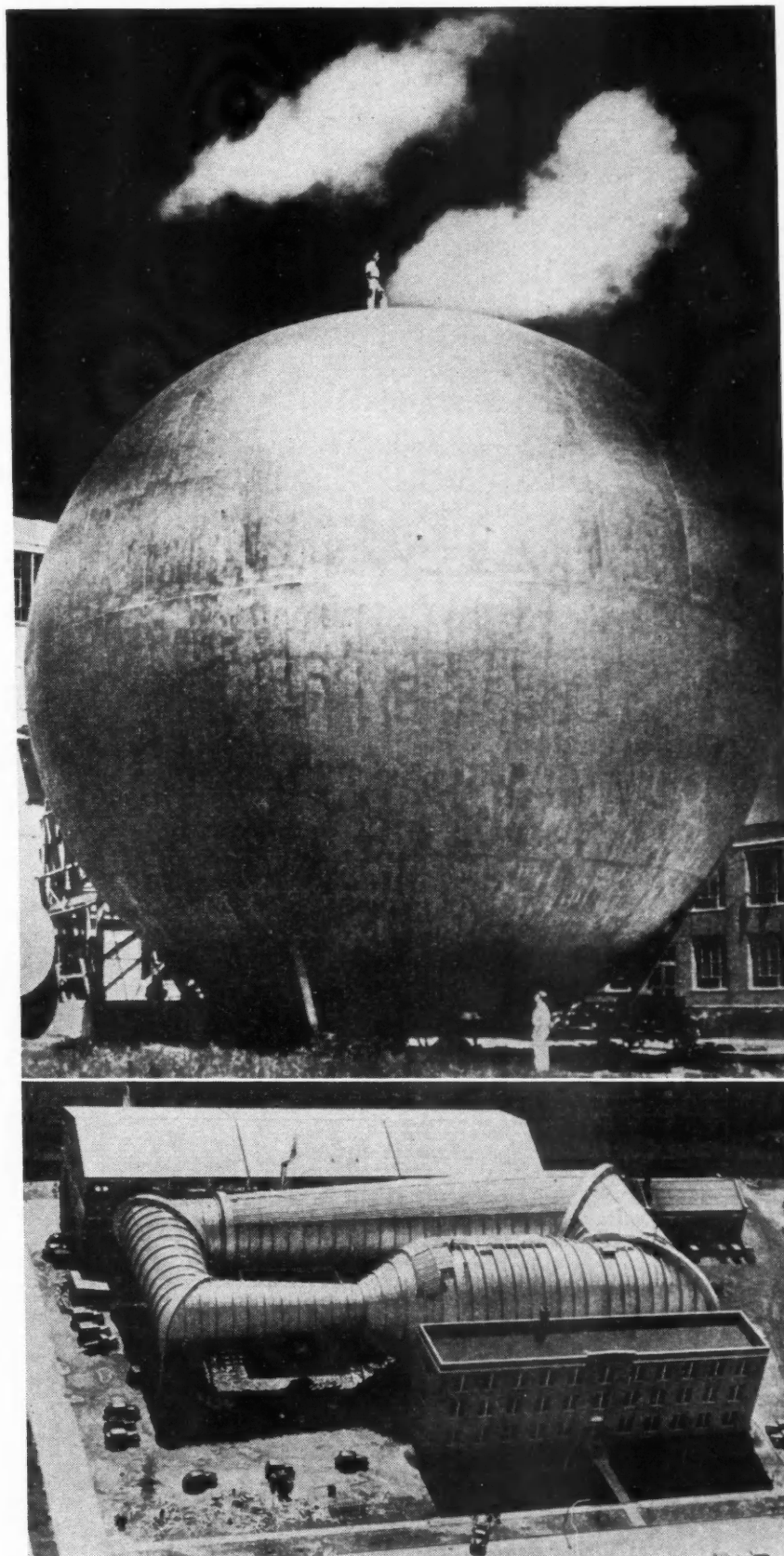
John B. White, who headed Buffalo and Western New York delegates to a preliminary week-end conference in Cleveland, said he had been assured Buffalo would be the next meeting place of the group at which a five-member committee of the council will be elected to bargain with the corporation.

## April Tax Collections On Trucks, Automobiles, Parts

Tax collections on trucks, automobiles, parts, etc., for April, 1939-1938, follows:

	1939	1938
Automobile trucks	\$566,614.86	\$747,762.74
Automobiles and motor cycles	3,664,378.58	4,289,635.82
Auto. parts and accessories	588,103.79	675,528.25
Tires	3,507,049.40	1,821,801.66
Inner tubes	654,059.41	364,179.26
Lubricating oils	2,190,594.41	2,456,640.72
Gasoline	15,182,327.75	16,436,553.87

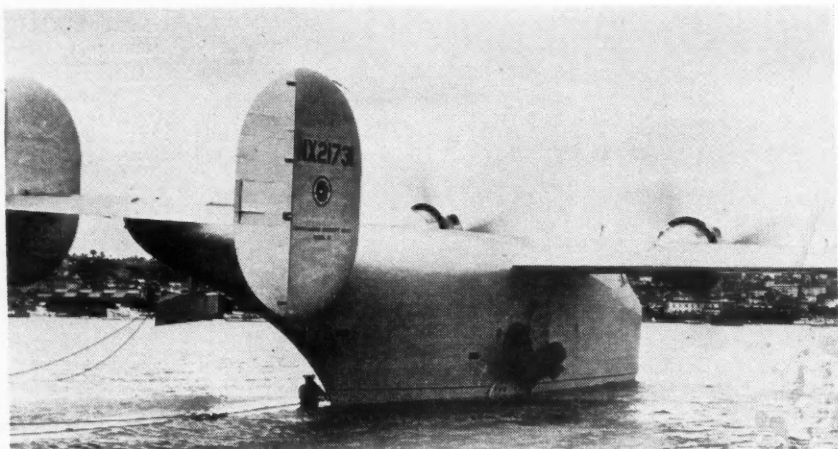
*Automotive Industries*



## 500 M.P.H. for The World of Tomorrow

The huge sphere shown above has been built at Langley Field, Va., to enable research engineers to study the stability and handling of large planes as duplicated in small models. The sphere is 60 ft. in diameter and will hold pressure of two or more atmospheres. Below is a view of the new 19-foot wind tunnel at Langley Field. This equipment was shown for the first time by the National Advisory Committee for Aeronautics at its conference held recently.

*June 1, 1939*



### 52 Passengers and a Crew of Five

The new 25-ton, double-decked, flying boat of Consolidated Aircraft Corp., San Diego, Calif., shown in the water just before tests got under way. The giant flying boat, which will carry 52 passengers and a crew of five, is reported to have passed all tests successfully.

## Expect Car Makers' Commitments For Sheet Steel for 1940 Models

*Start of Buying Seen This Month  
As Mills Tensely Watch Price Level*

Changes in third quarter prices, as announced by the leading steel producer, consist merely of elimination of quantity differentials, implying nothing more than recognition of their having been waived in recent transactions. On purchases exceeding 75 tons, prices remain unchanged from those now quoted. Recent developments, however, have further confirmed the impression that the actual market for sheets and strip steel has been \$4 a ton under the publicized quotations ever since last October's break in flat rolled steel prices. Some round lot business is known to have been placed recently by one of the large automobile manufacturers at prices virtually unchanged from those paid in the last six months. A number of finishing mills shared in this business, which was for May-June delivery. It is expected that commitments for sheets needed for 1940 model bodies will begin to come out this month, and with so heavy a tonnage demand overhanging the market, competitive preliminaries of all sorts are already under way. Publicized flat steel quotations have come to represent more and more a nominal level from which concessions, when it comes to tonnage business, have become the rule rather than the exception. It is this condition that causes nervous tension on the eve of buying for 1940 models. Quantity differentials have also been eliminated by wire producers. It is now thought that the decline in the rate of steel mill operations has about run its course. Rate of employed ingot activity for the week ending May 6 was 47.8 per cent; for the week ending May 13—47 per cent, and for the week ending May 20

—45.4 per cent. Pig iron producers are fearful lest lower steel prices affect the market for foundry iron.

Automobile manufacturers are thought to have covered their nearby needs of tin when the market was more favorable than it is at the present. Lack of interest on the part of consumers generally, when the price edged forward close to 50 cents, is

blamed for the market's lackadaisical performance in the last few days.

Buying in the copper market, which had been rather brisk, faded out when fabricators found that their incoming orders offered little support for the carrying of additional stocks of the base metal. Statistics issued by the Copper Institute showed an increase of 12,630 tons in world stocks, holdings of American producers having steadily increased in the last four months. The open market offers no advantage these days, spot electrolytic being now held at 10 cents by resellers as well as custom smelters and the majority of the mine producers.—W. C. H.

### Chrysler Corp. Quarter Profit

Chrysler Corp. and subsidiaries' operations for the first three months of 1939, according to the report to stockholders, earned a net profit of \$11,638,290.36, after all charges, equivalent to \$2.67 per share of common stock. This compares with \$2,109,969.52, or 48 cents per share, for the first quarter of 1938.

Net sales for the first three months of 1939 amounted to \$182,560,724.58 as compared with \$88,585,855.33 for the first quarter of 1938. Factory shipments of passenger cars and trucks aggregated 268,394 units, as compared with 122,928 units during the same period of 1938.

Retail sales in the U. S. of Plymouth, Dodge, DeSoto and Chrysler passenger cars, Plymouth and Dodge commercial vehicles, and Dodge trucks for the first three months of 1939 were reported as 178,618 units, as compared with 102,753 units for the same period in 1938—an increase of 73.8 per cent.

### AUTOMOTIVE INDUSTRIES

#### Summary of Automotive Production Activity

**BUSES** Slight gains in production reported. The statement of a large manufacturer who says "Things look good for the rest of the summer and there seems to be no chance of decreasing the schedule for at least six weeks" appears to be indicative of the general situation in this field. Inquiries on tractor type bus "trains," with passengers in the powered first unit and articulated second and third units, were reported.

**TRUCKS** Some indications of improvement in business, but the general picture remains about the same as for the past two months. One company feels that its deliveries this year will be about 35 per cent over 1938.

**TRACTORS** Production generally leveling off but stepped up in some cases because dealer stocks have been depleted. The wheat price rise is reported to be helping business.

**AUTOMOBILES** Output for May will probably be in the neighborhood of 325,000 passenger cars and trucks. Production expected to continue at steady pace during June although weekly totals for the industry probably will be lower than those maintained in May.

**MARINE ENGINES** Production is increasing slightly in several Eastern plants. Builders of large engines in Buffalo, Cleveland, and the mid-West report improved business, with some reporting increased backlogs of orders.

**AIRCRAFT ENGINES** Production schedules being increased to supply the demand for powerplants and parts. Backlogs continue to mount. Some additions have been made to several research staffs for development work.

*This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.*

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**Robert F. Black**

... who has been reelected president of the White Motor Co. for the fifth consecutive time. All White directors, also, were re-elected. The board consists of Mr. Black, Fred H. Chapin, W. King White, David L. Johnson, W. A. McAfee, E. J. Quintal, Otis A. Glazebrook, Jr., W. S. Searles and John H. Watson, Jr. Officers reelected in addition to Mr. Black were J. N. Bauman, vice-president in charge of sales; F. T. Macrae, Jr., vice-president in charge of manufacturing; W. S. Searles, secretary; Robert C. Lee, treasurer; H. P. Thornton, comptroller; Paul H. Rice, assistant secretary, and W. F. Merritt, assistant treasurer.

## April Federal Truck Sales Up 60 Per Cent

Domestic orders of the Federal Motor Truck Co. booked in April showed an increase of almost 60 per cent over the same month in 1938, and for the first four months of 1939 were 19 per cent ahead of the like period last year, the company reports.

"May is the second consecutive month that Federal has entered with a substantial backlog of orders," stated K. M. Schaefer, general sales manager, "many of which are for the new ¾-ton models, production of which started in late March."

## Yellow Truck Declares \$1.75 Quarterly Dividend

The Yellow Truck & Coach Mfg. Co. has declared a quarterly dividend of \$1.75 per share on the company's seven per cent cumulative preferred stock, payable June 30, 1939, to stockholders of record June 15, 1939.

# U.S. Car Exports to Argentina May Be Doubled Under New Plan

## American Manufacturers Offered 3-Year Bonds By Government of Argentina in Lieu of Cash

If American automobile manufacturers accept three-year bonds of the government of Argentina in lieu of cash, they may double this year's export quota to that country.

A plan negotiated by the Association of Argentine Automobile Importers removes one obstacle resulting from the unfavorable trade balance, but raises the problem faced by American manufacturers who must tie up funds in Argentine bonds, or have them discounted.

General Motors Corp. was one of the first to be granted a permit under the government-sponsored plan. The pact authorizes export of 4000 cars, calls for GM purchase of \$2,800,000 worth of the three-year bonds. The bonds will mature at the rate of 25 per cent at the end of the first year, 25 per cent more at the end of the second, and the balance at the end of the third year. They will be 2½ per cent issues.

International Harvester Co. has agreed to purchase \$500,000 worth of the Argentine bonds and it is expected that Chrysler and Ford will take advantage of the plan.

The 1939 quota, prior to the present plan, was 35 per cent of the cars imported from Dec. 1, 1937, to Nov. 30, 1938, a total of nearly 37,000 units, or about 13,000 vehicles. If American manufacturers take advantage of the new plan this quota will be doubled to about 26,000 cars and trucks.

The announcement of the 35 per cent-of-1938 quota did not increase the demand for European cars, according to reports of Argentine officials.

The reduced quotas resulted from depressed foreign trade in Argentina. This checked the influx of U. S. dollars in payment for goods exported from the Argentine. However, the demand for American automobiles continued, and the 35-per cent-of-1938 quota was

devised to check the disproportionate share of flow of dollars to automobile imports.

The reduced quotas left Argentine importers with a lively market, but no American cars to supply the demand. The importers pressed for some adjustment with their government, and this deferred payment plan, wherein the Argentine government acts as guarantor, and the bonds the guarantee, resulted.

Argentine automobile importers will pay their own government in pesos equivalent to the dollar value of their imports, reckoned at the going rate of exchange. The government then remits the bonds, payable in U. S. dollars, which are turned over to the American manufacturers.

About 90 per cent of cars imported by Argentina are of U. S. make, of which General Motors Corp. and Ford Motor Co. total 80 per cent.

The bonds have not been issued, and financial circles dealing with Latin America would not comment on the probable rate of discount should U. S. manufacturers decide upon this expediency to realize cash from this transaction.

## Caterpillar Has New Roadbuilder

Designed to handle an entire road-building job a new motor grader has been announced by Caterpillar Tractor Co. Called the No. 112, the new machine is available with either a gasoline or Diesel engine. Both engines have four cylinders with a bore of 4¼ in. and a stroke of 5½ in. and develop 46 maximum hp. at 1500 r.p.m. The machine has four forward speeds with a low of 1.8 and a high of 10 m.p.h. With the Diesel engine and tandem drive, the No. 112 weighs 17,800 lb.

## Sweeper

Fifty of these mechanical sweepers have been bought by the Department of Sanitation of New York City. Commissioner W. F. Carey (left) and Acting Superintendent M. A. Tierney look over the two-cylinder, tricycle sweepers.



Aeme



# Consumers Said to Hold Key to Stable Employment in Steel Plants

## U. S. Steel Corp. Head Tells TNEC That Production Schedules of Consuming Industries Are Vital Factor

Edward R. Stettinius, board chairman of the United States Steel Corp., told the Temporary National Economic Committee on May 17 that the automobile industry and other consumer industries will have to draw on the steel manufacturers in even quantities before the steel industry will be able to

level out its employment curves satisfactorily.

Mr. Stettinius, who was called before the anti-monopoly committee in its investigation of capital financing in an attempt to learn what impedes the flow of investment capital into private enterprise, said the consuming industries

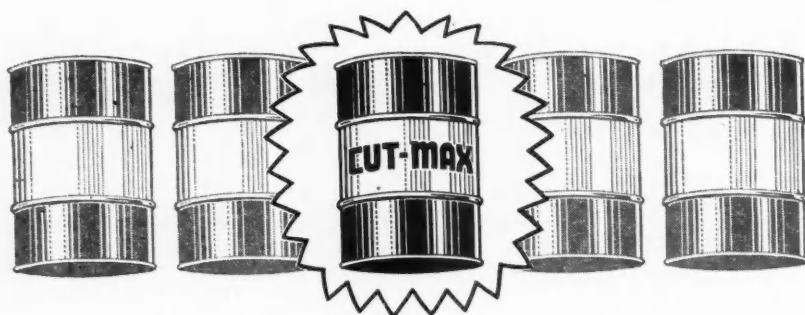
will first have to get their production schedules straightened out before the steel industry makes progress in any move to stabilize employment.

Describing the corporation's financing policy and how it had spent more than \$500,000,000 in the past 10 years in plant expansion and developing new steels to meet consumer demand, Mr. Stettinius said that the modern automobile was made possible by better steel.

"The all-steel top, with its added safety factor, and the new body, fender and hood construction are dependent upon the cold reduction method of producing steel sheets," the Steel Corporation spokesman declared. "Not only does this new process furnish a material capable of the pressing and shaping necessary, with one forming operation, in place of many, but it provides a surface on the steel itself so fine as to permit the excellent finish that is obtained by the use of a few coats of the new quick drying paints.

"This cold reduction process of producing automotive sheets, as well as the stock from which tin cans are made, is one of the most revolutionary steps in recent times, involving as it does the replacing of the old style sheet and tin plate processes and the expenditure of very large sums for their replacement. It has been found that rolling steel in the cold state produces a finer grained, more workable steel adaptable to wider uses."

As for alloy steels, Mr. Stettinius explained to the committee that the Society of Automotive Engineers has adopted a list of over 100 alloy steels for use in making various parts of automobiles, including gears, valves, springs, connecting rods, cams, and drive shafts. Stainless steel has entered into the construction of wing struts, ailerons, rudders and other parts of airplanes, he said, disclosing that United States Steel is experimenting with a mill designed to produce an extremely thin stainless steel strip for the wing and fuselage covering of planes. Such use of welded stainless steel is expected to bring about a marked increase in the speed of both commercial and combat aircraft by reducing wind resistance, he added.



"...the most satisfactory oil of those tested...."

So wrote a large and internationally-known manufacturer ... after running a large number of tests on cutting oils in his Automatic Screw Machine Department. The purpose was to determine which oil would give the best results. They chose

## CUT-MAX BASE No. 7

**It's  
Houghton,  
2 to 1**

A recent, national, independent survey on cutting oil preference found that Houghton is the favorite by 2 to 1 over the second choice — getting three times as many firsts as the nearest competitor. 50 years of super quality and performance have built this leadership.

Recently developed, this product is the most concentrated base ever created for dilution into cutting oils. It contains a minimum of 18% super-active added sulphur—combined in a colloidal state. CUT-MAX Base No. 7 is unequalled in refrigerating and cutting efficiency. We will prove this in your own plant, under actual operating conditions.

**E. F. HOUGHTON & CO.**  
240 W. SOMERSET STREET  
Chicago - PHILADELPHIA - Detroit

**THE HOUGHTON LINE  
OF STRAIGHT AND SOLUBLE CUTTING OILS**

## Japanese Aircraft Building Activity

Pursuant toward Japan's desire for self-sufficiency in the aircraft industry, by 1938 there were 23 manufacturing concerns in Japan proper making aircraft parts and accessories, with paid in capital then reported as ranging from \$24,534,000 to \$81,780, according to a report by the Bureau of Foreign and Domestic Commerce, Automotive-Aeronautics Trade Division. Because of the persistent pressure to expand, it was said that it is impracticable to ascertain the present capital. These companies claim to be manufacturing 25 different types of commercial aircraft,

ranging from the twin-engined 440 hp. Kotobuki to the single engined 28 hp. Tachikawa T.S.I.

The law concerning manufacturing aircraft, the report stated, provides government control of all phases, and only Japanese subjects are allowed to own and operate (under license) producing companies. Approved licensed concerns are exempt from business profits tax, land tax and import duties, and may issue bonds double the amount of authorized capital. Fourteen firms are reported to have received licenses. The government may order changes in terms and in selling service of planes.

## April Rim Inspections Totalled 1,348,335

A total of 1,348,335 rims were inspected and approved by the Tire and Rim Association during April, an increase of approximately 37.6 per cent as compared with the same month a year ago.

For the first four months of 1939 the number of rims inspected and approved by the association aggregated 6,235,218, an increase of approximately 120 per cent over the similar period in 1938.

## London Annual Used Car Show

### *Consulting Firm Certifies Condition of Each Vehicle*

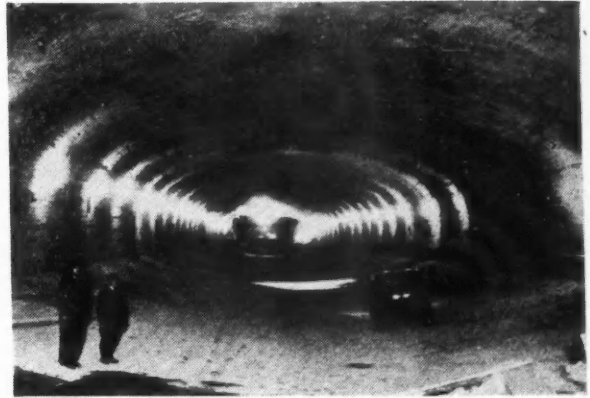
A private enterprise that has proved its value as a medium for the sale of used cars is the annual used car show held in London at the Agricultural Hall. Every one of the cars exhibited at this show carries a certificate of condition, signed and countersigned by automobile consulting engineers appointed by the organizers (William Glass & Co.) as a result of a road test and an inspection conducted in an adjacent hall.

A typical certificate of a 1934 model states: *Power Unit.* No undue wear is detected. *Performance* satisfactory. *Front Axle Assembly.* Some looseness in left-hand swivel pin; right-hand front tire fouls shock absorber on full lock. *Transmission and Rear Axle.* In good condition. *Chassis.* Rear spring hanger bracket loose on frame. Right-hand rear and left-hand front brakes binding. *Electrical Installation.* In good condition. *Body.* In fair condition. *Tires.* All good. *Brake Test.* Left front brake much below par, causing steering drag to the right. *General.* After correction of above defects this car should give satisfactory service.

Between 400 and 500 cars were shown at this year's exhibition. Most of the exhibitors were dealers in the Metropolitan district and they displayed cars with prices ranging from £25 to £500, from 10 years to 10 weeks old. Frowned upon originally by motor manufacturing interests, the show is now "recognized" by the Society of Motor Manufacturers and Traders.

## French Tunnel

This tunnel under the Park of Saint-Cloud, Paris, is the starting point of the new French highway system running from Paris to Rambouillet.



Acme



## You Wouldn't Intentionally Handicap Skilled Hands

It is often hard to determine from cost sheets exactly how much the unseen qualities of steel affect the production of your skilled shop men. If bars do not machine uniformly, if hard spots break or dull tools, if bars are too hard for bending and forming, if alloy steel parts must be re-treated to secure desired physical properties—then up go costs, down go profits.

This is one of the reasons why Ryerson has spent years in building up stocks of better, more uniform steels—steels worthy of the Ryerson seal of Certification.

All Ryerson certified carbon steels are made to rigid specifications that assure the most desirable qualities in each particular type of steel. Ryerson certified alloys are from selected heats in which the hardening factors (analysis, grain, size, etc.) are within a narrow range that assures uniform heat treatment response.

With every shipment, large or small, Ryerson sends accurate data on the chemical and physical properties of the alloy bars furnished. This added service is given without additional cost or obligation.

When you need steel—steel that responds to skilled hands and keeps production flowing smoothly—specify Ryerson Certified Steels. Stocks are complete and immediate shipment is assured.

Joseph T. Ryerson & Son, Inc. Plants at: Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

**RYERSON**  
*Certified*  
**STEELS**



## MEN . . . . .

A. W. Keller has been appointed technical sales representative for Maas & Waldstein Co.

J. M. Brancherry, with Graham-Paige Motors Corp. since 1934 as a field representative and later a district manager in the New England territory, has been named New England sales manager.

G. M. Stickell has recently been ad-

vanced from assistant sales manager to sales manager of the Landis Machine Co.

T. E. Barlow has been appointed metallurgical engineer of the Copper Iron and Steel Development Association, with headquarters in Cleveland. He will act as technical service representative of the association of copper producers.

W. D. Wise has been appointed advertising manager of the Fruehauf Trailer Co. Mr. Wise joined the Fruehauf organization in 1931 as a member of the sales department. He was en-

gaged in this department until 1933 when he was transferred to advertising work.

Marvin A. Heidt, who has been in charge of all personnel and industrial relations of the Budd Wheel Co., has resigned to become director of industrial relations of the Bendix Aviation Corp. products division at South Bend, Ind.

A. N. Benson, formerly general manager of the National Automobile Dealers Association, is now assistant to the president of National Dairy Council, with headquarters in Chicago.

John H. Hunt, director, new devices section, General Motors Corp., and Clyde R. Paton, chief engineer, Packard Motor Car Co., have been nominated as directors for the Engineering Society of Detroit.

The Stewart-Warner Corp. announces the advancement of Fred R. Cross, director of advertising, to the position of sales manager for the Alemite retail sales division. C. A. Fine, who formerly headed this division, will assume new duties in the organization. His position will be announced in the near future.

C. H. Kuthe has been appointed technical advisor to the Revere Copper and Brass corporation's Michigan division.

R. W. Arnold has been appointed to the position of DeSoto regional manager for the Dallas, Tex., region.

Dr. Zay Jeffries, eminent metallurgist, has been elected to membership in the National Academy of Sciences. Membership in the academy is limited to 350 members, and is recognized as the highest scientific rank an American can receive. The academy compares with the Royal Society of Great Britain and the French Academy.

Dr. Jeffries has contributed numerous important developments in the science of metals as a result of his research with tungsten lamp filaments, high strength aluminum alloys, and the application of X-Ray analysis to metallurgy.



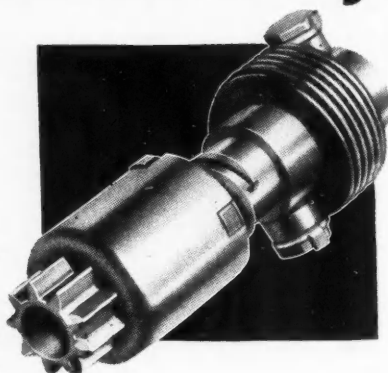
**M**ANUFACTURER, service man, owner—all the way through—there's one specification O.K. that checks with everyone. It's the Bendix Drive, the mechanical hand that cranks your car.

Every hour of every day the Bendix Drive proves its merit over and over again in millions of cars and trucks. Its operation is virtually fool-proof and trouble-proof. At the touch of the starter button, the Bendix Drive automatically takes hold, starts the engine, lets go—meanwhile protecting the starter from damage in case of inadvertent operation. Bendix Drive is built in sizes and types for every starting requirement.

ECLIPSE MACHINE DIVISION  
BENDIX AVIATION CORPORATION  
ELMIRA, NEW YORK

# BENDIX DRIVE

"The Mechanical Hand that Cranks Your Car"



## Chevrolet Sales Up 36% In First 10 Days of May

Dealers' retail sales of new Chevrolet cars and trucks in the first 10 days of May totaled 23,248 units, an increase of 1505 over the corresponding period in April, and of 6142 units, or 35.9 per cent, over the same 10 days last year.

The period brought Chevrolet's sales for the year to date to 291,765 units, the records indicate. This is 70,212 units more than had been sold at this time in 1938, the percentage of increase being 31.7.

Used car sales in the first 10 days of May were 46,663 units, the report showed. This represents a gain of 5181 units over the first 10 days of April,



and of 10,490 units over the first 10 days of May a year ago.

Chevrolet's truck sales, for the year to date, have gained 32.8 per cent with 64,322 sales, as compared with 48,409 at this time one year ago.

## Labor Factions Still Jockey for Position

### NLRB Holds Hearings On CIO Chrysler Petition

Clarification of the status of the two competing factions in the United Automobile Workers Union was moving along on two fronts during the latter part of May.

Suits filed by both of the contending factions in the Wayne County Circuit Court, each seeking to restrain the other from use of the union name, headquarters and treasury, were ordered held for trial on their merits after the court announced it could make no decision on the arguments presented by counsel representing both sides.

Meanwhile the National Labor Relations Board was holding hearings in Detroit on the petition of the CIO contingent of the union asking for its certification as the official representative of employees of the Chrysler Corp. Hearings were expected to determine whether the Board would grant the CIO-UAW petition or would call for an election at which employees would indicate which faction was the representative of a majority of employees. Early testimony in the hearings developed that if an election is held the CIO-UAW will demand that it be held amongst all production employees of the corporation while the independent UAW was holding out for election in individual plants of the corporation.

Just before members of the independent UAW began voting on the proposal to affiliate with the AFL, William Green, AFL president, issued a statement denying reports that such affiliation would give the UAW jurisdiction only over employees of automobile plants and parts plants wholly controlled by automobile manufacturers. Green announced that under the proposed affiliation the UAW would be fully autonomous as an industrial union, that jurisdiction would include parts plants as well as automobile plants, and that present AFL unions in automotive plants would be advised to become a part of the international UAW.

## Oldsmobile Sales Show Large Gain

Oldsmobile new car sales for the month of April totaled 14,554, according to D. E. Ralston, general sales manager. This represented an increase of 58 per cent over April last year. Total sales for the first four months of this year were 47,656, a gain of 53 per cent over the same period last year.

## Three-Day Week Schedule For Chevrolet in Buffalo

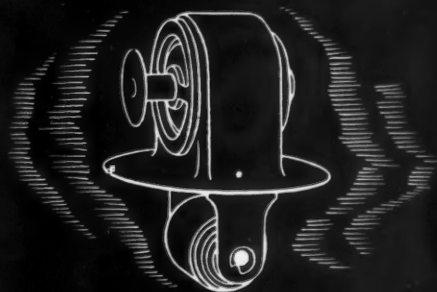
The new Chevrolet motor and axle plant at Buffalo, N. Y., has gone on a three-day week operating schedule for the first time since it went into production last spring.

The move affects approximately 1650 workers. Previously, the plant never had operated less than four days a week, with the exception of the first few weeks of production.

From present indications of demand, it appears that the three-day week will continue in effect until the end of June

when production of 1939 models of Chevrolet automobiles is scheduled to end, Alfred G. Gulliver, plant manager, said. After that will come a shutdown period of at least several weeks in preparation for new models.

"Most departments" in the Buffalo plant of the Ford Motor Co. are working five days a week, according to Robert F. Leonard, plant manager. Mr. Leonard reported that the Ford Motor Co. spent \$1,276,555 for wages in the Buffalo plant during 1938 and expended an additional \$5,951,535 for materials and services from Niagara Frontier suppliers.



## PRECISION BUILT TO MAINTAIN PREDETERMINED TEMPERATURE CONTROL

• Because automotive engineers constantly stake their reputation on equipment's ability to perform under a wide variety of road, load and weather conditions, they can make no compromise with precision.

It is significant that a large majority of leading automotive engineers depend on Dole Thermostats for precise pre-determined motor temperature control . . . and specify Dole Thermostatic Bi-Metal to assure accurate temperature response in devices of their own development.

Dole Double Port Poppet Type Thermostat . . . the leader in a line of star performers . . . positively eliminates sticking, binding and friction; it is balanced to control the circulation and temperature of water regardless of pump pressure.

Dole Thermostatic Bi-Metal . . . made to exacting specifications by time-tested precision procedures . . . are available in sheets, strips, coils, and fabricated parts ready for assembly.

Write or wire our engineering staff about your particular requirements.

**DEPENDABLE DOLE FITTINGS**—Range from compression couplings for all tubing connections to a complete assortment of water line end hose line parts for automobile hot water heaters.

## THE DOLE VALVE COMPANY

1901-41 Carroll Avenue • Chicago, Illinois  
Detroit Office: General Motors Building

# DOLE

## Thermostats

### AND THERMOSTATIC BI-METALS

# Chrysler to Protest New Car Shipping Rates at ICC Hearings

**Corporation Will Attack Commission's "Discrimination" Said to Favor Competitor Plants Outside of Detroit**

Speaking through its attorney, Parker McCollester, the Chrysler Corp. has informed the Interstate Commerce Commission that it will by its own witnesses and cross-examination of others and by argument raise the question of the reasonableness of the existing classification ratings of automobiles

at hearings to begin June 13 in Detroit before Examiners Disque and Lawton. The proceedings will cover a broad investigation of the rates, charges, rules, regulations and practices of all forms of common carriers relating to the transportation of new automobiles, other than less-than-carload shipments.



**GUARANTEED**

**Physical Soundness ~ Correct Hardness  
Size Accuracy and Sphericity**

A special lapping practice exclusive with Strom gives Strom Steel Balls a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Extreme precision can be obtained only through such a series of lapping operations.

Strom Steel Balls are forged from solid bar stock. They are scientifically heat treated under automatic control and are hardened all the way through.

So it is that Strom can guarantee physical soundness, correct hardness, size accuracy, and sphericity in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes. Write for catalog, prices.

**Strom**

**STEEL BALL CO.**

1850 So. 54th Avenue, Cicero, Ill.

*The largest independent and exclusive Metal Ball Manufacturer*

Mr. McCollester said that the Chrysler presentation will deal with the reasonableness as maxima of existing rates by all forms of transportation from Chrysler plants at Detroit, Evansville, Ind., and Los Angeles to all destinations and the extent to which the several forms of carriers may be permitted to go without violating the minimum rate provisions of the statutes in meeting each other's competition.

It was stated that Chrysler Corp. also proposes to attack the rates from its shipping points in relation to the rates from all points at which either the producing plants or the assembly plants of other automobile manufacturers are located.

"It has been reported," said the McCollester letter, "that others have endeavored to keep this issue from being raised in the present proceedings, but we will submit that it constitutes one of the principal issues as to the existing rate structure and that if not gone into the investigation will be incomplete, unfair to us, and preferential to our competitors. Among other things, we propose to show that the railroads have gone much farther in meeting truck and drive-away competition from the assembly plants of our competitors than they have from our plants and that the discrimination resulting therefrom has been aggravated by the suspension by the Commission of reduced rates from Detroit, while it has declined to suspend reduced rates published by the railroads serving plants of our competitors at other points."

## PUBLICATIONS

A booklet has been published covering Westinghouse Electric's participation in lighting, transportation, air conditioning, etc., at the New York World's Fair.\*

Two bulletins have recently been made available by the National Conference of Business Paper Editors. One covers the Conference Board's *Indexes of Manufacturing Inventories*; the other, No. 13 in the board's studies in personnel policy, covers *developments in company vacation plans*.\*

A book, *The Microscope in Elementary Cast Iron Metallurgy*, by Roy M. Allen, has been published by the American Foundrymen's Association. Price of this book, which may be purchased from the association's offices at 222 W. Adams St., Chicago, is \$3.00.

A new technical bulletin covering the properties and uses of "PVA" polyvinyl alcohol has been issued by the R. & H. Chemicals department, E. I. duPont de Nemours & Co. Applications of the product for grease-proof coatings, textile sizing, adhesives, molded articles and protective coatings are described. Chemical data dealing with viscosity, blending characteristics, solubility and film strength are included.\*

No. 31 in a series of booklets on current economic and social problems by Farrel-Birmingham Co., Inc., is entitled "The Coming Halt in Population Growth."

A booklet "Are Highways a Public Util-

ity?" has been published by the National Highway Users Conference. The booklet is stated as exposing "a fallacy of a theory that is being used as the basis of demands for increased taxation of owners of motor vehicles."\*

A folder on **ferrous castings** has been released by Belle City Malleable Iron Co. and Racine Steel Castings Co. The folder describes the properties and nature of the four types of ferrous castings produced by these companies and gives some suggestions and examples of their applications.\*

A 24-page catalog has been issued by the American Metal Hose branch of the American Brass Co. covering **seamless flexible metal tubing**.\*

The mechanical features and illustrations of the applications of the **61 hp. Caterpillar Diesel D-7 tractor** are presented in a new booklet, form 5330, just issued by the Caterpillar Tractor Co.\*

Circulars showing a complete line of **engine jacket water coolers** have been published by Young Radiator Co. No. 13638 describes six models with three physical sizes of units. No. P-168 shows a different series of units, also in six models with three physical sizes. No. P-166 illustrates Young Tube and Bundle type **heat exchangers** offered in a variety of sizes for cooling oil, water or gases.\*

The Marketing Research division, Department of Commerce, Bureau of Foreign and Domestic Commerce, announces the release of the "**Consumer Market Data Handbook, 1939.**" This edition of the handbook contains 82 series of statistical data, over one-third of which have never been published before. The publication, containing 463 pages of consumer market data, may be purchased for \$1.75 from the Superintendent of Documents, Washington, D. C., or from your nearest district office of the Bureau.

Comprehensive information on the **application and selection of steam turbines** is contained in a new 48-page booklet just announced by the Westinghouse Electric & Manufacturing Co.\*

Two new folders have been issued by Wm. E. Hooper & Sons Co., manufacturer of Fire Chief canvas and Fire Chief compound, describing and illustrating the use of **treated canvas** for roofing, decking, building construction, boat covers, tarpaulins, etc.\*

\* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

## Crude Rubber Stocks Down

Consumption of crude rubber by manufacturers in the United States during the month of April, 1939, is estimated to be 44,166 long tons, which compares with 50,165 long tons during March, 1939. April consumption shows a decrease of 12 per cent under March but is 48.6 per cent over April a year ago, according to statistics released by the Rubber Manufacturers Association, Inc. Consumption for April, 1938, was 29,730 (revised) long tons.

This organization reports gross imports of crude rubber for April to be 29,601 long tons, a decrease of 24.1 per cent under the March figure of 38,989 long tons, and 3.9 per cent under the 30,807 long tons imported in April, 1938.

This association estimates total domestic stocks of crude rubber on hand

April 30 at 190,896 long tons, which compares with March 31 stocks of 205,936 (revised) long tons and 303,901 (revised) long tons on hand April 30, 1938.

## Santa Fe Buys 30 New 1000-Hp. Diesel Units

The Santa Fe Railway recently purchased 30 new 1000 horse-power Diesel switch engines and one 4000 horse-power Diesel passenger engine.

The passenger engine and 13 switchers were ordered from the Electro-

Motive Corp., of Illinois, 12 switchers from the American Locomotive Co. and five from the Baldwin Locomotive Co. This will bring the total of Diesel switch engines in service on the Santa Fe to 41 and will give the company a total of 37,500 Diesel horse-power in its switching service. When the engines are delivered, Santa Fe will have the largest fleet of Diesel power in operation on any road in the world.

### Lawrence M. Viles

Lawrence M. Viles, chairman of the board of directors, The Buda Co., died on April 27.

# A NEW IDEA

## To Show Your Boss



Does your boss know that Delta Drill Presses are the finest labor-saving machines you can have in your shop? He will appreciate it if you show him how—in addition to handling their regular jobs of production drilling and tapping—these low-cost Drill Presses can be used to get additional operations at **no direct labor cost!** Delta Drill Presses are portable and self-contained. They may be placed alongside other machines, such as a milling machine, so that the milling machine operator can operate the Drill Press during the cutting period of the milling cycle. In this way, labor costs on many

operations can be entirely eliminated! This is but one of the many applications whereby Delta low-cost tools bring extra profits. Want to know more? Let us send you complete information today. Just send the coupon.

## DELTA Mfg. Co.

(Industrial Division)

606 E. VIENNA AVENUE  
MILWAUKEE, WISCONSIN

Delta Mfg. Co. (Industrial Division)	
606 E. Vienna Ave., Milwaukee, Wis.	
Please send me complete information on Delta low cost high-efficiency power tools.	
Name .....	.....
Firm .....	.....
Address .....	.....
City .....	State .....



# Aircraft Industry Urged to Aid In Increasing Skilled Workers

## Government Seeks Cooperation in Adding 60,000 Employees Immediately

An interdepartmental Committee headed by Oswald Ryan of the Civil Aeronautics Authority has outlined plans for cooperation by the aircraft industry, vocational schools and government agencies to make about 500,000 aviation mechanics available for war

time demands, recommending that the industry immediately double the number of mechanical employees.

The report, which said that only 40,000 factory workers are now employed in the industry and that the maximum requirement to meet authorized air ex-

pansion program will necessitate 60,000 additional workers, made these recommendations and observations:

1. Apprenticeship systems be immediately established in all aircraft manufacturing plants through local joint trade apprenticeship committees with Federal agencies cooperating.

2. Public vocational and trade schools should be encouraged to assist aircraft companies, to raise standards of instruction and to expand their courses to meet the need for junior technicians, and to cooperate with the National Youth Administration.

3. Youths in NYA work centers showing aptitude for mechanical trades should be given aid to secure employment as apprentices or as beginners in aircraft plants and helped to continue instructions in public vocational schools teaching aircraft trades.

4. Continuing studies to determine the number of supervisory and skilled workers required in the industry in war time, giving full consideration to the maximum breakdown of skilled jobs into semi-skilled operations.

The report apportioned the 60,000 additional workers needed immediately as follows: 10,000 supervisory and skilled personnel; 20,000 semi-skilled workers, and 30,000 workers requiring little or no particular skill.

Where you repeat the process of handling materials in production, it is frequently possible to reduce costs substantially by using a P&H Trav-Lift Crane. Designed for moderate service, these low-cost installations are saving money in many types of work. Bulletin H-13 describes them; gives complete engineering data on all sizes and types from 1 to 15 tons capacity. Ask for your copy. Harnischfeger Corporation, 4559 W. National Avenue, Milwaukee, Wis.

## HARNISCHFEGER CORPORATION

HOISTS • WELDING ELECTRODES • MOTORS



EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

## ADVERTISING

A national conference is being planned by the National Industrial Advertisers Association, to be held in New York, Sept. 20-22, at the Hotel New Yorker, under the sponsorship of the Technical Publicity Association of New York and the Industrial Marketers of New Jersey. "The 1939 N.I.A.A. National Conference is being planned definitely to stimulate business in the marketing field," states Edward A. Phoenix, of Johns-Manville Corp. and chairman of the general conference committee. "Throughout the conference stress will be laid on industrial marketing." The program will consist of general sessions and a series of 11 clinics.

The General Tire & Rubber Co., Ltd., Toronto, Ont., has considerably extended its use of newspaper space this year. Its advertisements will appear in major cities across Canada until the end of September.

Robert B. Owens, Jr., for the past 13 years with Campbell-Ewald Co. of New York, and with Campbell-Ewald in Detroit, has resigned. For several years, while in Detroit, he headed the agency's used car merchandising and advertising department. More recently, he was account executive on the U. S. Rubber Co.'s tire account, as well as director of the tire advertising activities of the Rubber Manufacturers Association.

Launching a nation-wide survey of

industrial advertising budgets, the National Industrial Advertisers Association has mailed data sheets requesting information to practically all industrial concerns in the country having an advertising appropriation.

Packard has announced an extensive advertising campaign featuring recently-announced price cuts of from \$100 to \$300. Young & Rubicam is the agency in charge.

Allen, Heaton & McDonald, Inc., Cincinnati, has been appointed agency for the new Crosley automobile. R. B. Dods, advertising manager, reports.

North British Rubber Import Co. of America, New York, has appointed Ray McCarthy Advertising Service to direct its advertising. Newspapers and business papers will be used.

Les Mayes has joined the advertising department of United Air Lines, Chicago. He was formerly with Howard H. Monk Advertising Agency, Rockford, Ill.

The 50th anniversary of Standard Oil Co., Indiana, will be celebrated by a sizeable increase in advertising, Wesley I. Nunn, advertising manager, has announced.

A new house organ, "Friends Magazine" is being sent to more than half a million owners of late model Chevrolets. The 24-page magazine will be published monthly and sent to owners selected by Chevrolet dealers. It is edited by the Motor City Publishing Co.

## New Awards Under Walsh-Healey Act

The Division of Public Contracts, Department of Labor, has announced the following awards under the Walsh-Healey Act:

United Aircraft Corp., Pratt & Whitney Aircraft division, East Hartford, Conn., Navy, engines, \$570,694.61; General Motors Corp., Chevrolet division, agriculture trucks, \$73,644.50; Steuart Motor Co. (Ford dealer), Washington, D. C., agriculture, station wagons, \$38,557.54; Fargo Motor Corp. agriculture, trucks, \$24,115.52.

## Latest Air Speed Marks

The world's absolute air speed record was broken twice recently in quick succession. Up to last March the record stood at 709 km. per hr. (441 m.p.h.) and was held by the Italian Agello, who established it with a seaplane equipped with two Fiat engines of a combined horse power of 2800. In March last this record was broken by Capt. Dieterle of the German Air Force, who flew a Heinkel pursuit plane at the speed of 746.66 km. (464.34 miles) per hour. Later this record in turn was broken by Fritz Wendel who with a

Messerschmidt Me 109R landplane set a new mark of 755 km. (469 miles) per hour. Both the Heinkel and the Messerschmidt planes were equipped with the new Mercedes-Benz DB-601 aircraft engine.

## Motor Wheel Corp. Declares Dividend

The board of directors of Motor Wheel Corp. has declared a quarterly dividend of 40 cents per share on the company's common stock, payable June 10.

## American Forging & Socket Co. Dividend

Directors of the American Forging & Socket Co. declared a dividend of 12½ cents per share on outstanding stock. The dividend was payable June 1 to stock of record May 20.

## George M. Sherman

George M. Sherman, aged 66, for 39 years manager of the traffic department of the Studebaker Corp. and for 54 years an employee of the company, died Monday.

# SHOCK-PROOF PARTS

*call for...*



# COLD FINISHED STEEL

Hundreds of impacts per minute plus gruelling wear and bending stresses . . . are all in the life of a piston pin. Much depends upon this humble but vital part, and it must be tough enough to take years of punishment.

The quality and uniformity of B & L Cold Finished Steel makes it the logical material for shock-proof parts and other heavy duty applications in the building of modern motor cars.

A bar of piston pin stock is made up into many duplicate parts . . . and all must be alike for equal serviceability. That is why uniformity counts . . . and the reason that finely produced B & L Bar Steels are so generally specified in automotive construction.

*B & L service engineers will be glad to advise on the use of Cold Finished Steels in the fabrication of your products.*

## BLISS & LAUGHLIN, INC.

HARVEY, ILL.                      BUFFALO, N.Y.

*Sales Offices in all Principal Cities*

Cold Drawn Bars \* Ground Shafting \* Leaded Steels \* Screw Stock \* Extra Wide Flats \* Alloy Steels

## First Quarter New Car Registrations, 616,104

U. S. new passenger car registrations in the first quarter of 1939 totaled 616,014, exceeding the 447,346 registrations in the like period of 1938 by 37 per cent, according to R. L. Polk & Co.

The Polk tabulations were announced following completion of March registration figures which showed sales for March 1939 reached a mark of 247,860. This represents an increase of 50.27 per cent over February, when 164,942 units were registered, and a gain of

36.77 per cent over March 1938, when total registrations were 181,222.

It was pointed out by Polk, however, that March figures include an estimate for the State of Tennessee.

In the truck division, the first quarter national registration total is 116,226, a gain of 20.07 per cent over the 96,801 registrations in the first three months of 1938.

The March 1939 truck total was 44,909—a gain of 20.54 over the 37,255 of March 1938 and a gain of 31.69 compared to the 34,102 registrations in February, this year.



**YES, SIR-**  
*it's an*  
**ACCURATE**  
*Spring*

HERE is a flat wire spring that will have the mighty important job of keeping an automobile door closed. Slam! — Bang! — open and shut — thousands and thousands of times. Tough job? — sure but it's an Accurate Spring — built to take it!

COMPRESSION  
SPRINGS

•  
EXTENSION  
SPRINGS

•  
TORSION  
SPRINGS

•  
FLAT SPRINGS

•  
WIRE FORMS

•  
STAMPINGS

You can almost tell that it is Accurate-made by simply looking at those perfect coils. But the most important features of an Accurate Spring you can't see! We mean — the research — the design and engineering — the precision manufacture — all the things that build the quality of Accurate Springs. Always insist upon those advantages. Send us your blue prints or ask to see an Accurate engineer.

Remember "the best springs are Accurate".

**ACCURATE SPRING MANUFACTURING CO.**  
3811 W. Lake Street Chicago, Ill.

## 40 YEARS AGO

The subject now uppermost in the minds of many members of the motor vehicle cult is how soon an exclusively motor vehicle exhibition could profitably be held. Steps are now being taken to organize one in Chicago next fall, we are informed. This seems a little premature. A better date would probably be early in the year 1900, say in January or February, so that manufacturers would have time to profit by the knowledge gained from the show and govern their product accordingly. By that time a fairly representative showing could be made of no less than four or five different kinds of motors—electric, gasoline, steam, carbonic acid and—let us hope, compressed and liquid air.

In consequence of the embryonic state of the industry in this country all the displays of motor vehicles up to the present time have been made in connection with cycle or electric shows, and for this reason can scarcely be regarded as unqualified successes. The new impetus which has been given to the movement this year, however, encourages the belief that the industry will soon be strong enough to stand alone.

From *The Horseless Age*, June 1899.

## New Car Financing Up 40.9% in March

The dollar volume of retail financing of new passenger automobiles was 40.9 per cent higher in March than during the same month of 1938, and 36.9 per cent off from March 1937, according to preliminary estimates by the Department of Commerce. As compared with February, 1939, retail financing of new cars showed an increase of 41.4 per cent.

## Murray Corp. Reports First Quarter Profit

The Murray Corp. of America in its report for the three months ended March 31 indicated a net profit of \$13,941.22. A net loss of \$80,936.71 was shown for the same period in 1938. The board of directors, at its April meeting, voted to change its fiscal year to end Aug. 31.

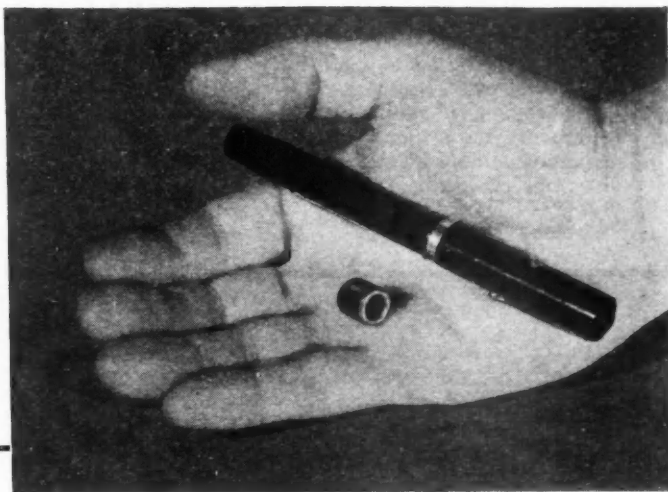
## Correction

In the 1939 Statistical Issue of *Automotive Industries*, Feb. 25, on page 218 appeared a table "Passenger Car Chassis and Engine Trends, Based on Units Sold." The 1938 data should be corrected to read 5,743,000,000 lb. gross shipping weight of cars sold; 169,246,000 gross maximum horsepower of cars sold; giving an average weight of 3035 lb. and average hp. of 89.



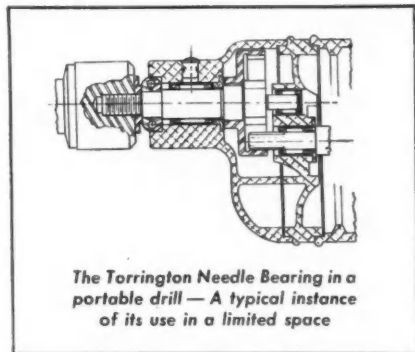
# WHEN SPACE IS AT A PREMIUM

## use the TORRINGTON Needle Bearing



**D**o space limitations in the design of your products seem to demand the use of plain bushings? Then you can frequently secure the advantages of anti-friction construction by changing over to the Torrington Needle Bearing.

Because of its simple design and its small diameter, the Needle Bearing can often be substituted for a plain bushing



without requiring additional space. Consider, for example, the portable drill illustrated—a typical application where space is at a premium. See how easily

three Needle Bearings were incorporated in the design. In most cases the Needle Bearing can be mounted in your present housings; a change in the size of housing bore is the only design modification needed to accommodate the bearing.

### Change is Inexpensive

You will find the change-over to anti-friction construction surprisingly inexpensive. The Needle Bearing is lower in unit cost than other types of anti-friction bearings, and its installation involves little labor expense. Built as a single compact unit, with the rollers permanently assembled in a hardened retaining shell, the bearing is readily pressed into position in the housing bore.

Your customers will appreciate the greater efficiency of the Needle Bearing, and the small amount of service attention it requires. Lubrication is efficient and thorough. The retaining shell, provided with turned-in lips, forms a reservoir for grease or oil, and the rotation

of the needles constantly supplies lubricant to the rotating shaft.

The Needle Bearing is ideally suited for severe service in high-speed application. Its full complement of rollers provides many linear inches of contact, with consequent high radial load capacity.

If you are using plain bushings because of space limitations, investigate the possibilities of this small anti-friction bearing. The Torrington Engineering Department will assist you in laying out applications.

For further information, write for Catalog No. 7. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

**The Torrington Company**  
ESTABLISHED 1866  
**Torrington, Conn., U.S.A.**

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities

# TORRINGTON NEEDLE BEARING

# FTC Hearings in GM Exclusive Dealers Case Resumed in Detroit

*Ourselves and Government—A Check List  
Of Federal Action Corrected to May 22*

## FEDERAL TRADE COMMISSION

**SIX PER CENT CASE.** Final arguments on Ford case were presented May 4. Next move will be either an order or dismissal by the Commission. Similar case involving the FTC complaint of false and misleading repre-

sentations as to interest charged automobile purchasers under deferred payment plans is pending against General Motors.

**VS. UNITED STATES RUBBER CO. and its subsidiary U. S. Tire Dealers Corp.** (No new developments.)

**FAIR TRADE PRACTICE RULES.** (No new developments.)

**F.O.B. PRICE CASE.** (No new developments.)

**GENERAL MOTORS EXCLUSIVE DEALER CASE.** Hearings were resumed in Detroit, May 25.

**KASTAR SPECIALTY MFG. CO., INC.,** New York. Ordered to discontinue "representing that it manufactures the automobile accessories it sells unless and until it owns and operates a plant in which such articles are made."

## DEPARTMENT OF LABOR

**STEEL WAGE CASE.** (No new developments.)

## Strike at Briggs Curtails Lincoln, Chrysler Plants

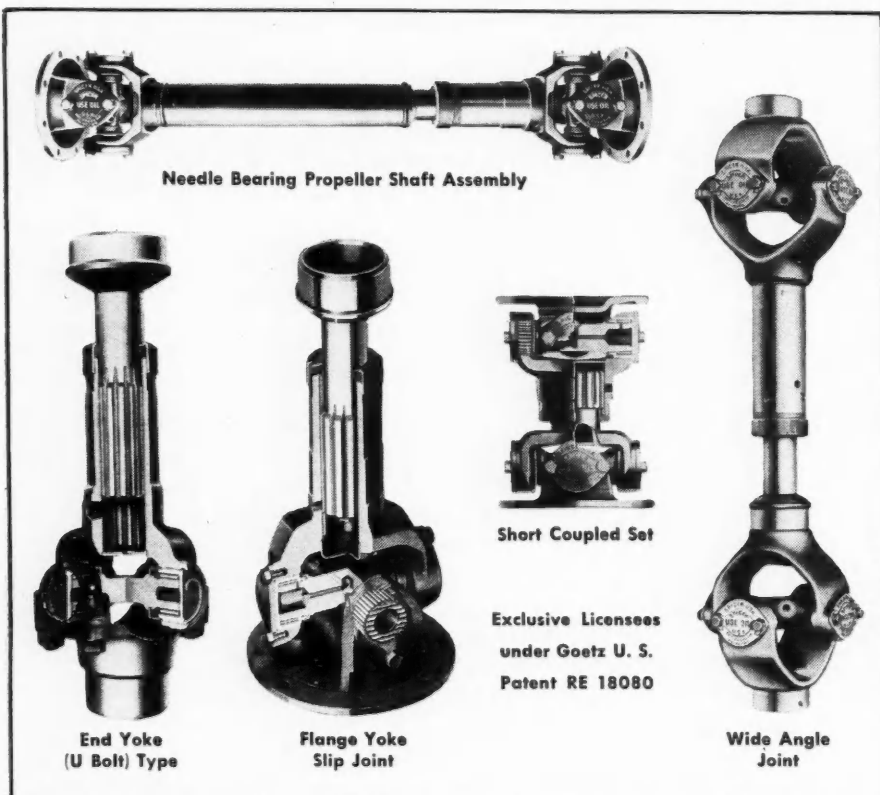
A strike which closed seven plants of the Briggs Mfg. Co. also resulted in drastic reduction of operations in ten plants of the Chrysler Corp. and the Lincoln division of the Ford Motor Co. and made a total of more than 70,000 automotive workers idle on May 22 and 23.

The strike was called by Briggs local 212 of the CIO-UAW after negotiations on a new contract were stalemated because of the union's insistence on settlement of a long list of grievances and its refusal to submit the grievances to arbitration. Closing of the Briggs plants which supply bodies to Chrysler Divisions and Lincoln almost immediately affected these producers who were obliged to lay off thousands of production employees. Additional companies affected were parts manufacturers supplying Briggs, and Great Lakes shipping vessels transporting Chrysler cars. Further unemployment was anticipated unless the strike was settled immediately to which end the U. S. Department of Labor immediately dispatched its star conciliator, James F. Dewey to Detroit.

## UNIVERSAL JOINTS & PROPELLER SHAFTS FOR MANY REQUIREMENTS

● Consult us on your joint problems. We have needle bearing joints and propeller shafts available and in production in many different types and sizes. Short coupled, wide angle

and inter-axle types to meet special requirements. Standard propeller shafts can be furnished with either end yokes or flange yokes with companion flanges. Write today.



Short Coupled Set

Exclusive Licensees  
under Goetz U. S.  
Patent RE 18080

## Spicer Manufacturing Corporation • Toledo, Ohio

BROWN-LIPE  
CLUTCHES and  
TRANSMISSIONS

SALISBURY  
FRONT and REAR  
AXLES

SPICER  
UNIVERSAL  
JOINTS

PARISH  
FRAMES  
READING, PA.

## ABSTRACTS

### Dopes for Diesel Fuels

It has long been known that the anti-detonating qualities of Diesel fuels can be improved by the addition of certain chemicals such as amyl nitrate, which act as negative catalysts. In France, M. Clerget has studied the effects of alcohol additions, and especially of additions of ethyl and methyl nitrate. By adding 5 per cent of ethyl nitrate to a gas oil, the cetane number was raised from 62 to 80, and a 10 per cent addition of the nitrate increased it to more than 95. He also discovered that the action of the anti-detonant was improved by the addition of benzoyl bromide and of amyl bromide.

Ch. Bertholet, on the other hand, has pointed out in his book on *Technique et Economie Nouvelles des Carburants de* (Turn to page 691, please)

## Men and Machines

(Continued from page 669)

Speed changes are made by means of pick-off gears at the rear of the head. Speeds of 100 to 1335 r.p.m. are available with a 1200 r.p.m. motor, while a maximum of 2000 r.p.m. may be obtained with an 1800 r.p.m. motor.

Unlike other machines of this type, the No. 1-M carries a table with three T-slots for maximum facility of setup.

Distance from table to center of spindle ranges from 1 in. minimum to 8 in. maximum. The stroke of the head feed lever moves the head 4 in. This 4-in. stroke may be obtained anywhere within the total range of head movement, which is 7 in. Cross adjustability of quill is 2½ in., and maximum distance from center line of table to spindle nose is 5 in. The machine is a product of Kent-Owens Machine Co.

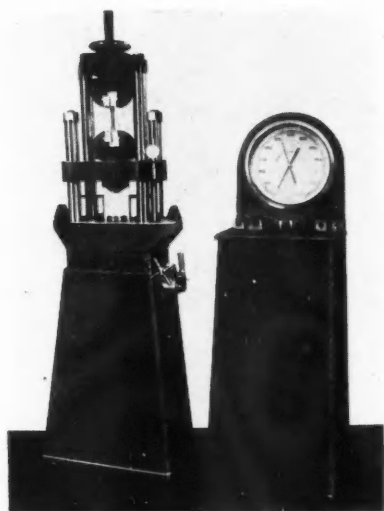
The latest development in self-contained hydraulic presses for deep drawing of sheet metal by The Hydraulic Press Mfg. Co., Mount Gilead, Ohio,

change of direction are obtained without shock, and idle ram travel in closing and opening accomplished within minimum time by patented Fastraverse system.

A unique characteristic of this H-P-M triple action press is the operation of the second and third hydraulic actions for the blankholder and die cushion functions without additional sources of hydraulic power. The power of the one radial pump, applied first

### Index of Machine Tool Orders

The volume of machine tool orders for April was somewhat under the March figures. According to the National Machine Tool Builders' Association report, the indexes were off in both domestic and foreign orders so that the total index as 155.6 was down to 16 per cent. The three months' average trend was reported at 169.4, slightly over the March figure.



A new 60,000 lb. universal testing machine built by the Detroit Testing Machine Co., Detroit. Load is applied hydraulically by means of a motor-driven pump.

is the new H-P-M "Fastraverse" Triple Action Press.

The press embodies three separate hydraulic actions for operating, respectively, the main draw punch, the blankholder ring and the die bottom of the regulation triple action drawing die. The draw punch is carried by the main slide actuated by the main hydraulic press ram of a double acting piston type. This is powered by an H-P-M Hydro-Power radial pump connected directly to the press cylinder in the patented valveless H-P-M closed circuit. Press ram movements are thus controlled through regulation of the pump output, which is both variable and reversible. Rapid ram action and

**GET A  
BETTER FINISH  
WITH  
GREATER  
ECONOMY**



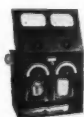
**CUTTING LUBRICANTS**

● Cutting costs without sacrificing finish and accuracy is a problem in every shop. Cities Service Cutting Oils in your shop may be the answer to your problem.

Cities Service Cutting Oils are *Service Proved*. They have been proved, through many years of service to the metal working industry, to be oils that turn out work that meets the demands of the most discriminating customers.

Behind these cutting oils is the Cities Service Lubrication Engineers Department. This organization will cooperate with you on your metal cutting lubrication problems—Their recommendations will help you turn out your work properly and at the same time may save you money.

A new booklet "Metal Cutting Lubrication—In Theory and Practice," is on the press. Write for your free copy.



This is the "Heat Prover"—an ingenious device that might be helpful to you. It's a by-product of our research in metallurgy. It registers, continuously and instantaneously, changes in the amount of oxygen and combustibles in furnace gases. Invaluable in the heat treatment of metals,—assures uniformity and reduces scrap losses. Let us tell you how you can obtain the use of one.

**CITIES SERVICE OIL COMPANY**  
SIXTY WALL TOWER—Room 1626A,  
NEW YORK, N. Y.

Please send me information concerning the Engineers' Lubrication Service (check box) ☐

Please let me know how I can get Heat Prover Service.....(check box) ☐

Please send me booklet "Metal Cutting Lubrication".....(check box) ☐

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City \_\_\_\_\_

**SERVICE PROVED INDUSTRIAL OILS**



through the main press ram, is thence distributed through other groups of rams to the blankholder slide and die cushion. Furthermore, the force exerted by each of these members is regulated independent of either the other or the main ram tonnage.

The blankholder slide, being directly beneath the main slide, is made with a center opening to clear the draw punch. This slide provides the blankholder ring with a solid continuous support and guiding nearest the contact with the work.

A completely enclosed cable and drum type electric hoist has just been

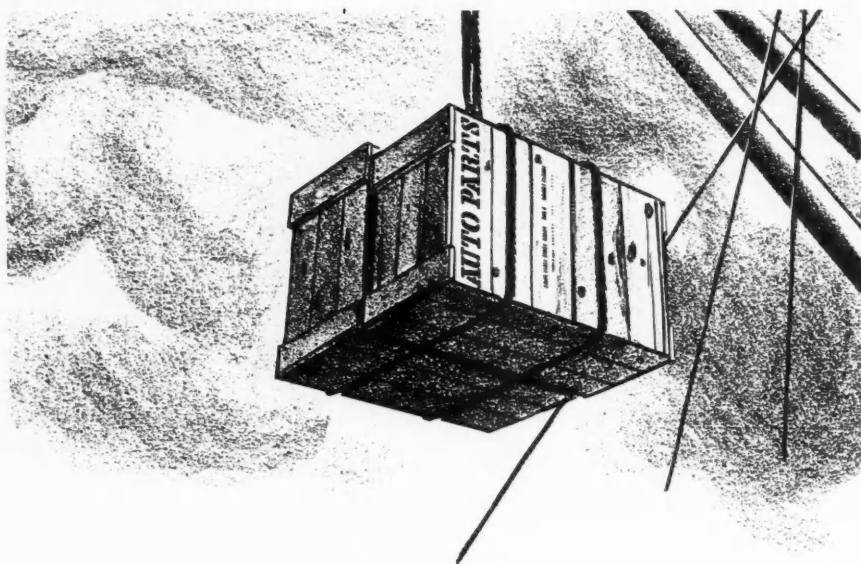
placed on the market as the Conco Torpedo Electric Hoist. It is available for either trolley, hook or lug suspension, and in capacities from 250 to 1000 lb.

The mechanism of the hoist is fully enclosed in an oil tight, weather proof, dust proof housing. Only two gear reductions are employed in the hoist—one worm gear and one spur gear—the spur gear of high carbon steel; the worm of forged steel and the worm gear of chilled phosphor bronze. All gear shafts operate on anti-friction bearings, with gears and shafts fully enclosed and operating in a bath of oil.

The new hoist is of double drum construction, equipped with cast iron drums with left and right hand machined grooves. Drums are thirty times cable diameter. A minimum factor of safety of eight is provided for cable on hoists of all capacities. The hoist is manufactured by the Conco Engineering Works, Division of H. D. Conkey & Co., Mendota, Ill.

For firms and institutions with limited funds to spend on testing equipment, the Tinius Olsen Testing Machine Co., Philadelphia, has announced a moderately priced, compact L-type hydraulic testing machine. This machine has a capacity of 20,000 to 60,000 lb.—yet its overall height is but 63½ in., occupies only ten square ft. of floor space, and has an approximate net weight of 2000 lb.

A moving piston supplies the necessary testing strain. The gear pump is the direct-connected type with a constant operating speed which, when the load is applied, produces no measurable pulsation. Testing speeds range from 0 to 2 in. per minute in stepless intervals, the control of which is a



## FOR TIMBUCTOO AND SINGAPORE

Replaceability of parts, the very principle which simplifies the servicing of automobiles the world over, is the basic fundamental of the popular Schrader Tire Valve. One Schrader Cap . . . one Schrader Core will fit any standard type tire valve, regardless of the size of valve, tire, or the type of vehicle. New Schrader Caps and Cores cost but a small fraction of a complete new tire valve and can be quickly replaced by anyone without removing tire, tube or wheel. No special equipment is necessary.

A. SCHRADER'S SON, BROOKLYN, N. Y.  
Division of Scovill Manufacturing Company, Inc.

# Schrader

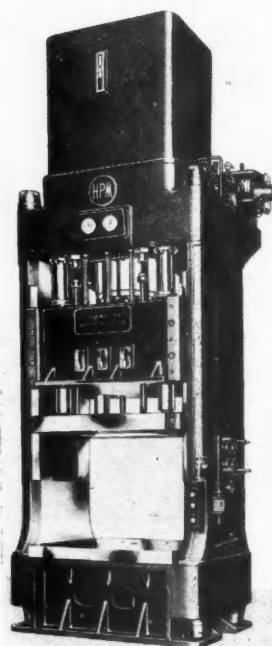
REG. U.S. PAT. OFF.

## TIRE VALVES

THE STANDARD FOR EQUIPMENT AND REPLACEMENT

### INTERCHANGEABILITY SIMPLIFIES INVENTORY

The interchangeability of Schrader Tire Valve parts reduces delays in tire and vehicle servicing and simplifies the inventory problem for the entire trade.



Hydraulic Press Mfg. Co.'s  
new H-P-M "Fastraverse"  
triple action press.

pilot handwheel 8 in. in diameter. A separate pilot is furnished, with an additional valve, for holding or removing load.

An important feature is that the piston and cylinder require no packing, being ground to the rigid tolerances. Any slight leakage is compensated for by the oil used in the loading system, which forms a seal between piston and cylinder. Friction is reduced to the minimum, therefore, and the load is weighed within the close limits set by A. S. T. M. specifications.

(Turn to page 690, please)



## THE FEWER, THE BETTER

The demand of the times for more production per dollar, without sacrifice in quality, brings into sharper and sharper focus the necessity for the use of the most modern materials. It is natural that the more different steels specified in machine construction, the greater the fabrication and stock room complications.

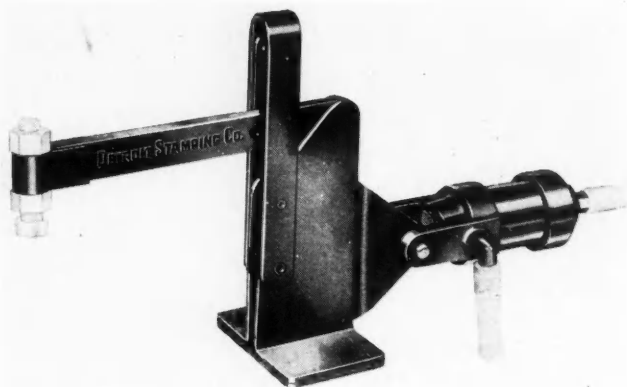
To reduce these complications, many manufacturers are taking advantage of the versatility of Molybdenum Steels. One, a builder of a varied line of

heavy duty machines, replaced four different alloy steels with Chromium-Molybdenum Steel (SAE 4140) for everything from heavy crank shafts to small screw machine parts.

Overhauling your own material specifications may disclose similar opportunities for highly profitable standardization on a versatile Molybdenum steel. To assist you we will gladly send our technical book "Molybdenum in Steel", free upon request.

PRODUCERS OF MOLYBDENUM BRIQUETTES, FERRO-MOLYBDENUM, AND CALCIUM MOLYBDATE

**Climax Mo-lyb-den-um Company**  
**500 Fifth Avenue • New York City**



*New model De-Sta-Co toggle clamp with built in air cylinder.*

A new model De-Sta-Co toggle clamp with built-in air cylinder has just been placed on the market. Attached to the air line and operated with a Ross air control valve, this new clamp is said to be particularly useful on fixtures requiring multiple clamping operations, as for holding large sheet metal panels, wherein one air valve can be made to control and operate several De-Sta-Co clamps. Detroit Stamping Co., West Detroit, is the manufacturer.

The Blanchard Machine Co., Cambridge, Mass., has made formal announcement of a new demagnetizer which it placed on the market within the last year. The device has two coils, one at each side of the gap in the C-shaped core, so designed that when connected to a source of single phase alternating current there is produced in the gap a very intense alternating magnetic field. By placing magnetized pieces in this field and slowly withdrawing them they are completely demagnetized.

The gap is adjustable and has a maximum opening of 6 in. The demagnetizer can be supplied with winding for any of the usual voltages and frequencies of alternating current, but direct current cannot be used.

A. L. Hansen Mfg. Co., Chicago, has developed a new model T-2 one-hand automatic tacker which is said to be especially useful in cramped or close quarters and capable of driving into unusually hard material.

The new model, which measures only  $\frac{3}{4}$  in. at the front, will handle tack-points of four different lengths ranging in size from  $\frac{3}{16}$  in. to  $\frac{1}{2}$  in. Tack-points are only  $\frac{1}{8}$  in. at the crown, and when driven are almost invisible.

Mechanism of the machine can be inspected simply by opening the front jaw, which operation requires only a few seconds. The jaw remains in locked position while the tacker is in operation.

The device is recommended by the manufacturer for tacking finishing braids and borders on window trims, etc.

#### **Publications Available on Machine Tools**

Catalog No. 11, covering *hand drivers and power bits for Phillips screws* and also power screw driver bits for slotted head screws has been issued by the Apex Machine & Tool Co., Dayton, Ohio.\*

The improved Taber V-5 *stiffness gage* manufactured by the Taber Instrument Co., North Tonawanda, N. Y., is described in the company's Bulletin No. 3802. The gage is designed for the accurate measurement of the stiffness quality of paper, light metallic sheet, and wire.\*

Landis *heat treated die heads* are the subject of a new bulletin published by the Landis Machine Co., Waynesboro, Pa.\*


\* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

## **LETTERS to the Editors Prove Reader Interest**

Since MOTOR AGE has been edited for Independent Service Stations only, AUTOMOBILE TRADE JOURNAL for Car Dealers only, and MOTOR WORLD WHOLESALE for Wholesalers only . . . 1 out of every 11 readers writes to the Editors.

When AUTOMOBILE TRADE JOURNAL was an all-coverage, omnibus publication reaching these three fields . . . 1 out of every 25 readers wrote to the Editor.

That makes over twice as much evidence of reader interest in these specialized publications.

**CHILTON  COMPANY**

CHESTNUT and 56th STS. PHILADELPHIA, PENNA.



## Dopes for Diesel Fuels

(Continued from page 686)

*Synthèse* (Dunod, Paris, 1937) that if 0.5 per cent of ethyl nitrate and 0.5 per cent of benzoyl bromide are added to a medium-volatility distillate of low-temperature tar, the duration of combustion is reduced by more than two-thirds. Other proposed dopes for Diesel fuels include mercury compounds and various organic products such as fulminates, nitrobenzenes, etc.—*La Technique Moderne*, May 1.—H. E. B., Jr.

## CALENDAR

### Conventions and Meetings

- SAE World Automotive Engineering Congress ..... May 22-June 8
- American Society for Testing Materials, Annual Meeting, Atlantic City ..... June 26-30
- Automotive Engine Rebuilders Association, Seventeenth Annual Convention, Baltimore, Md. .... July 5-7
- National Petroleum Association, Annual Meeting, Atlantic City, Sept. 14-15
- American Welding Society, Annual Meeting, Chicago ..... Oct. 22-27
- American Trucking Association, Annual Meeting, Chicago ..... Oct. 23-24
- American Petroleum Institute, Annual Meeting, Chicago ..... Nov. 13-17
- National Independent Traffic League, Annual Meeting, Chicago..... Nov. 23-24

### Shows at Home and Abroad

- Great Britain, London, Automobile Show ..... Oct. 12-21
- National Automobile Show, New York, Oct. 15-21
- Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11
- International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6
- Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11
- National Truck Show, Chicago.... Nov. 8-16
- Great Britain, Glasgow, Scotch Automobile Show ..... Nov. 10-18

## Track-type Tractors Since 1904

(Continued from page 640)

of sleighs deep into the winter blizzards of the Arctic North. Pulling loads of heavy mining machinery, these tractors are taking an outstanding role in the development of the distant and little-known resources such as the rich radium and gold deposits that have recently been found. Then there is Matanuska Valley in Alaska, where several hundred hardy souls from the United States are carving out a new living on Government grant land. A fleet of track-type tractors has been assigned to the job of logging, land breaking and a score of other tasks.

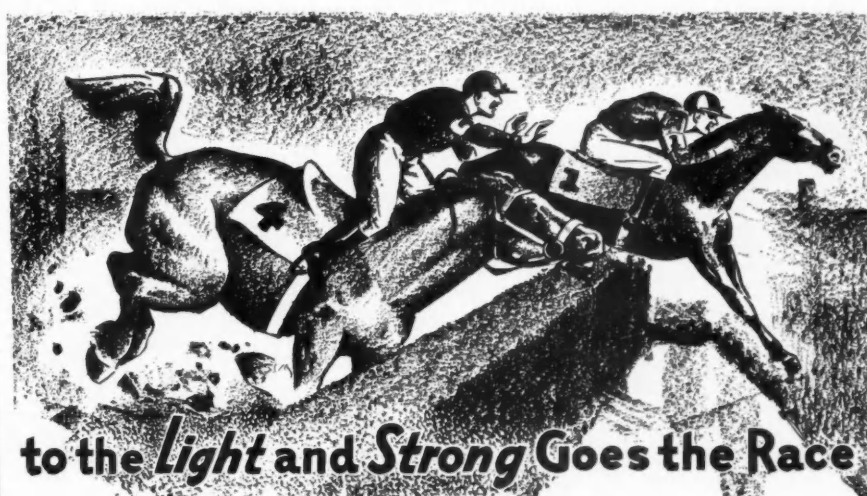
The pioneers of trans-ocean airplane travel have depended a great deal on

the track-type tractor. In developing bases on distant Midway and Wake islands in the Pacific, Pan-American Airways purchased a number of these machines. Likewise, a large fleet of track-type tractors has just completed a gigantic landing field in Newfoundland, eastern base for trans-Atlantic plane service.

Track-type tractors follow in the wake of disaster. Behind the floods of Louisville and Los Angeles and the windstorms of Florida and New England, have gone fleets of these machines helping to reestablish communication and transportation, to prevent epidemics, to repair water and other

public service facilities and, as in California, to salvage the land itself, and in New England to get timber into the hands of the public before it is destroyed by the ravages of nature.

To the engineer great homage should be paid—all through the history of the track-type tractor as it has been put to ever more difficult and more severe tasks, it has been the engineers, the designers, the metallurgists, the experimental staffs, the field observers, who have met the challenge by producing ever better machines, who have made the product that has contributed so much to the economic and social progress of the world.

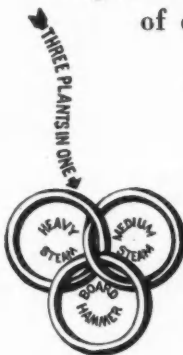


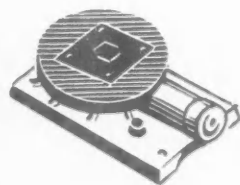
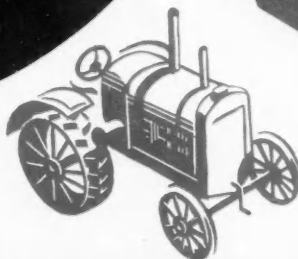
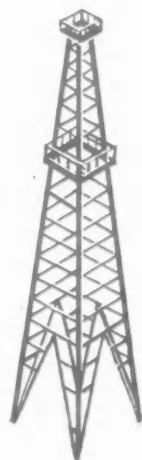
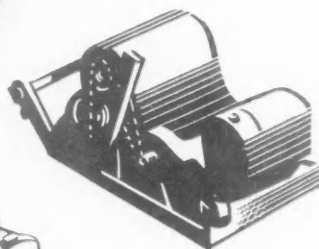
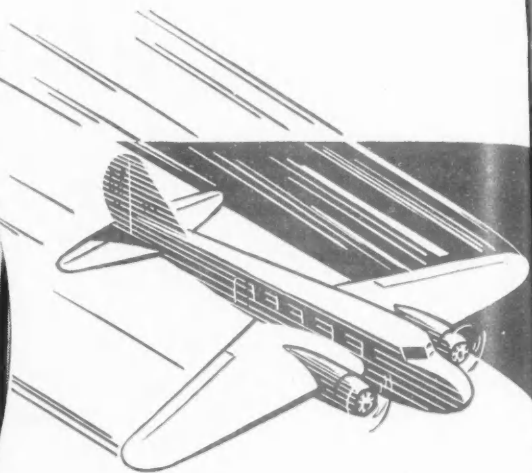
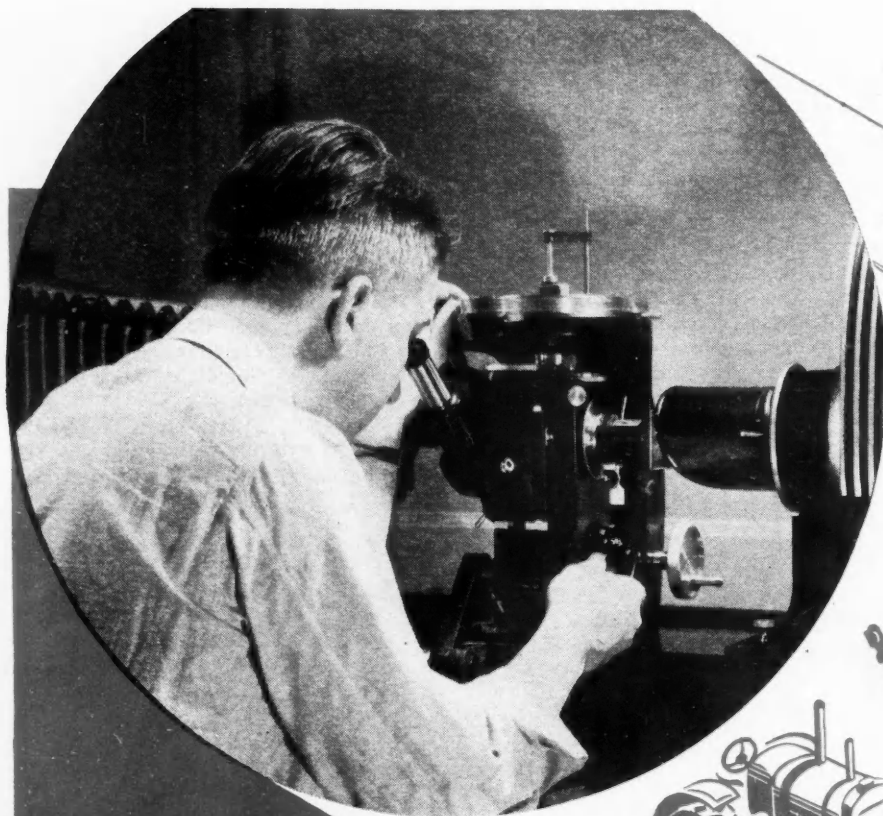
That drop forged steel is the strongest known metal for all highly stressed parts is a generally accepted fact, and Atlas has done more than any other forging manufacturer in finding new uses for the many alloy steels now in common use.

Lightness, strength and clean design of Atlas Drop Forgings cut down operating weights, assure safety and make economical shop operations.

Atlas Drop Forgings are engineered to your particular requirements. A call when your work is on the drafting board will bring Atlas Engineers to aid in design, material selection and many other useful ways of constructive assistance.

*A Forging Is More Than Just a Shape  
or a Symbol Number at Atlas*





# 30,000 TESTS a year for your PROTECTION

## REPUBLIC STEEL CORPORATION

GENERAL OFFICES: CLEVELAND, OHIO

ALLOY STEEL DIVISION: MASSILLON, OHIO • SALES OFFICES IN ALL PRINCIPAL CITIES

BERGER MANUFACTURING DIVISION • UNION DRAWN STEEL DIVISION • STEEL AND TUBES, INC.

TRUSCON STEEL COMPANY • NILES STEEL PRODUCTS DIVISION